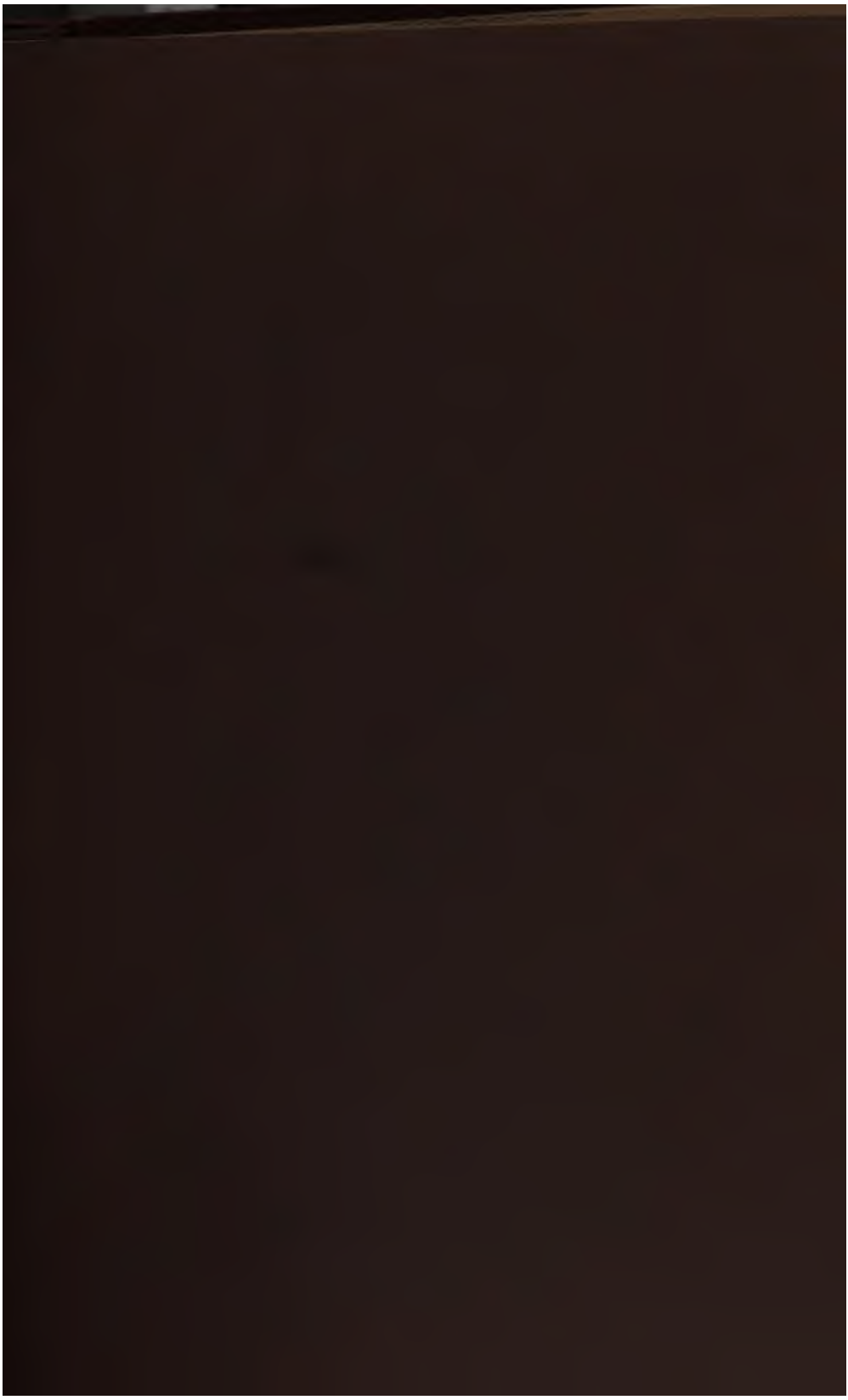

P. A. Harrington,
U. S. Navy.

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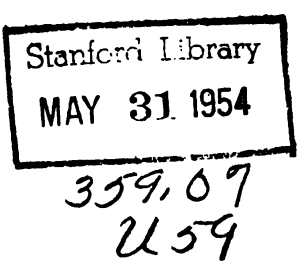

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The writers are responsible only for the contents of their respective articles.

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NOTICE.

ANNAPOLIS, MD., *February 10, 1897.*

Having carefully read the four essays submitted in competition for the prize offered by the U. S. Naval Institute for the year 1897, we have the honor to announce that, in accordance with Article XI. of the Constitution, the prize is awarded to the essay bearing the motto, "Everything in order," on Torpedo-Boat Policy, by Lieutenant R. C. Smith, U. S. Navy.

Honorable mention is accorded in the order named to the essays bearing the mottoes: (1) "From little spark may burst a mighty flame," on A Proposed Uniform Course of Instruction for the Naval Militia, by Mr. H. G. Dohrman, Associate Member, U. S. Naval Institute; (2) "And another came, saying, Lord, behold, here is Thy pound, which I have kept laid up in a napkin; for I feared Thee, because Thou art an austere man," on Torpedoes in Exercise and Battle, by Lieutenant John M. Ellicott, U. S. Navy.

EDWIN WHITE, Commander, U. S. Navy.
ASA WALKER, Commander, U. S. Navy.
B. F. TILLEY, Commander, U. S. Navy.
E. B. UNDERWOOD, Lieutenant, U. S. Navy.
DAVID DANIELS, Lieutenant, U. S. Navy.
N. M. TERRY, A. M., Ph. D.,
Professor, U. S. Naval Academy.
H. G. DRESEL, Lieutenant, U. S. Navy.
Members, Board of Control.

NOTICE.

Further discussions on articles in this number are requested. They will be published in succeeding numbers.

H. G. DRESEL, Secretary and Treasurer.

THE PROCEEDINGS

OF THE

UNITED STATES NAVAL INSTITUTE.

Vol. XXIII., No. 1. 1897. Whole No. 81.

PRIZE ESSAY, 1897.

MOTTO: "Everything in Order."

TORPEDO-BOAT POLICY.

BY LIEUTENANT R. C. SMITH, U. S. Navy.

INTRODUCTORY.

It seems probable that the United States, after many years hesitation, is now about to enter on a policy of torpedo-boat construction. The desirableness of such action is hardly open to criticism.

We shall have twenty-three boats of the different classes when all that are now authorized shall have been accepted. An inspection of the lists of foreign warships will show that the ratio of torpedo-boats to other classes is nearly as two to one. Our ratio at present is more nearly the reciprocal of this.

It cannot of course be assumed that in every country there is the same ratio to be observed between the various elements of the fleet. The numbers of torpedo-boats, for instance, will be influenced by the general policy and the extent and character of the coast, as well as by the actual size of the navy. It is not intended here to take up more than casually the question of the number of boats it would be desirable to build in the United

States, but it may be remarked in this connection that whatever arguments have been advanced in other countries in favor of torpedo-boats, either in reference to their use with the squadron as circumstances indicated, or to the special features of the coast which might lend themselves to torpedo-boat operations, apply with if anything greater force to the case of the United States.

It has been held abroad that torpedo-boats are the weapon of the weaker naval power. A power that is strong in ships will be able to bring commanding numbers against the ships of a weaker enemy. She has no imperative need for many torpedo-boats. On the other hand, the weaker power here finds its opportunity. The latter requires torpedo-boats, the former torpedo-boat destroyers. Continuing the argument, a nation which may be attacked by superior numbers on its own coast may find the torpedo-boat a weapon of the greatest value.

But it is when the natural features of our coast are considered that the argument in favor of torpedo-boats presents itself in the strongest light. The extent and configuration of the coast, and especially the amount of inland-water navigation, seem to make the torpedo-boat a weapon peculiarly suited to our special requirements.

Thus there cannot be any reasonable doubt as to the desirableness of increasing materially the torpedo-flotilla; but there may be, and in all probability is, considerable doubt as to the characteristics of its components. In the past twenty years there have been first and second-class torpedo-boats, sea-going torpedo-boats, torpedo-cruisers, torpedo-rams, torpedo-gunboats or catchers, torpedo-vedette-boats, torpedo-boat destroyers. Which of these different types should we copy after for the present, and what should be the military features of the types selected? As we have little experience of our own, the practice of other nations will be for the present a useful guide.

It is necessary here to review, in a general way, the course of torpedo-boat construction abroad, after which we shall be in a better position to form an opinion as to our own needs.

The vessels to be considered are those in which the automobile torpedo forms the chief or a very important feature of the armament. Submarine torpedo-boats are not here included. The subject is a large one in itself, and requires separate treatment.

Torpedo-Boats Proper.

The modern torpedo-boat, from all accounts, owes its origin to the fast launches fitted for spar-torpedoes, built first by Thornycroft, Yarrow and the Herreshoffs. When machine and rapid-fire guns practically put an end to this form of weapon, it was a step only to the automobile torpedo in the same type of boat.

A precursor of the spar-torpedo launch was the Miranda, a fast river-launch, built by Thornycroft in 1871. She was just short of 50 feet in length, and made 16¼ knots, at that time an unprecedented speed. The hull was of Bessemer steel. She had two cockpits and a low glass deck-house. A locomotive boiler supplied steam at 120 pounds pressure to a two-cylinder vertical engine. Here were many features of later torpedo-boats.

In 1873 Thornycroft turned out a torpedo-launch for Norway, which I believe was called the Rasp, and which was a great advance on any previous attempt. This boat was 57 feet long and made 17¼ knots on trial. She had compound engines and the usual locomotive boiler. She was fitted to tow a torpedo from the top of the smoke-pipe. The Glimt for Sweden in 1875 was very similar and made 18 knots.

The Herreshoffs were among the earliest in this field. Their Lightning was built for the Bureau of Ordnance in 1876. She was a wooden launch of 58 feet over all and weighed about three tons. The boiler was of the patent safety-coil type, supplying steam at 140 pounds pressure to a two-cylinder 5 by 10 engine running at 400 revolutions a minute. This boat actually made in 60 minutes on trial 20.3 statute miles with and against the tide, equivalent to 17.6 knots. She was fitted for the spar-torpedo.

A noted boat of this time (1876) was the Gitana, a yacht built by Thornycroft for the Baroness Rothschild to run on Lake Geneva. She was of steel plates, 86 feet long on the water, and displaced 29 tons. A locomotive boiler supplied steam at 100 pounds pressure to a three-cylinder compound engine running at 325 revolutions. She was guaranteed to make 36 miles in 2 hours, but actually made 43 miles in 1 hour and 48 minutes, or at the rate of 20¾ knots.

Thornycroft's Lightning for the British government dated from 1877. She was 84 feet long and was designed for 18 knots, but made 19.4 on preliminary trials. This was the first real

torpedo-boat. Her armament was the Whitehead torpedo discharged from the forward deck. She was made rather heavier and with fuller lines than her predecessors, in order to withstand rough weather if necessary. She also had more complete cabin arrangements to permit remaining at sea for longer intervals. Her engines made 350 revolutions with 120 pounds of steam. In other respects she resembled earlier boats.

Messrs. Yarrow & Co., of Poplar, had also turned out a number of fast launches of various sizes. Their first torpedo-boat was built for the Argentine in 1874. She was of steel, 55 feet long and made 12½ knots on 65 indicated horse-power. She was fitted for the McEvoy spar-torpedo.

In 1877 they built Nos. 17 and 18 for the English government. These boats were 86 feet long, of 33 tons displacement and made 21 knots on 450 indicated horse-power. Their armament was two torpedo-tubes. No. 14, by the same firm the following year, was practically the same size, but made 21.94 knots on 550 horse-power, and was the fastest vessel of its day.

Boats now began to be known as first and second-class, according as they were of a size to act independently or were designed to be carried on shipboard. The distinction still holds generally, though boats for ships are sometimes now called third-class.

The second-class boats were first fitted with side frames for discharging the 14-inch torpedo. The torpedo was lowered over the side and was started parallel to the keel-line by its own motive power, using a laniard to haul back the starting lever. The speed of the boat required to be reduced to permit this.

Steam was next used for the discharge. The torpedoes were laid in troughs on the forecastle and ejected by a steam piston with a stroke of 7 feet. This method did not require the speed of the boat to be slackened. It was designed by Yarrow.

Air-discharge was the next form, and this was used mostly in the larger boats, until followed much later (about 1884) by the now almost universal gunpowder method.

In 1878 there were several French boats, built by various firms, of 108 feet and 45 tons. Their speed was 19 knots. They had two torpedo-tubes.

The Herreshoffs built a boat for the English government in 1879. She was fitted with one of their coil boilers. The first

apparent effect on English practice was the fitting of second-class boats to take live steam from the ship's boilers through a flexible pipe, in order to hasten the time of getting underway. Thornycroft's tubulous boiler followed about four years later, the first of which went into a Missionary steamer on the Congo. The Herreshoff boat was about 60 feet long and realized 16 knots. There were several novelties besides the coil boiler. She was of composite structure with steel frames, planked below the water and plated above. The shaft inclined downward at first, but was brought back to the horizontal by running it through a curved brass tube which gave it a long bearing. The shaft had sufficient elasticity to revolve in this position. The screw was well under the body of the boat. The long bearing formed a sort of fin-keel, as well as a surface condenser for the exhaust steam. As the deadwood was cut away abaft the screw, it also formed a pivot for turning and made the boat very handy.

In 1880 Thornycroft had reached a type of first-class boat for England, 90 feet long with a speed of 22 knots. This boat was fitted with a ram bow as a result of an experience in a collision at Portsmouth in February, 1880, in which a boat with a straight stem had her bow completely stove in against the side of another boat. Apropos of this, Mr. Donaldson, of the Thornycroft firm, said in a lecture before the Royal United Service Institution in April, 1881, "All our boats are now fitted with the ram bow, strengthened so as to be useful as a means of offense in an action between boats." This principle seems to me a very important one and will be referred to again.

The armament of this boat was three Whitehead torpedoes, two in transporting carriages, one on each side of the deck, and the third in a tube on the bow. The tube was pivoted, permitting it to be trained ahead and on either beam. The torpedo was ejected by a telescopic impulse tube actuated by compressed air.

The Batoum was built by Yarrow for Russia in 1880. She was 100 feet long and made 22 knots. She was the first so-called sea-going torpedo-boat, and made the trip from London to Nikolaief, 4800 miles, at an average speed of 11 knots. She was fitted with twin bow tubes and carried four 19-foot Whiteheads. This was the first boat to be fitted with a turtle-back deck.

In 1881 Thornycroft built a boat for Denmark, the Svaerd-

fisken, of 110 feet, with twin bow tubes and an armament of four 19-foot, 15-inch Whiteheads. The discharge was by compressed air admitted in the tube behind the torpedo, which is the present method with air-discharge. Her torpedoes carried a charge of 80 pounds of gun-cotton and had a speed of 20 knots for 1000 yards. This boat was guaranteed to make 18 knots for 3 hours, but was expected to exceed that speed. She actually made 20.

In 1882 Yarrow completed a 100-foot boat for Italy of the Batoum type which made 22½ knots on trial. This was the highest record to date. This was considered to be a very efficient sea-going type. Ten similar boats had been navigated to the Mediterranean the previous year, and two across the Atlantic. This boat had all the Yarrow special features, such as bow and stern rudders, turtle-back deck and water-tight ash-pan. The bow rudder had been first used in 1878. It was arranged to raise and lower, or to drop altogether if it became entangled. Used in conjunction with the after one, it reduced the diameter of the turning circle practically one-half. The turtle-back deck has since become very common. It sheds the seas well, but a greater advantage is the added strength it gives to light structures by its curved surface. The water-tight ash-pan was an arrangement to prevent extinguishment of the fires in case the compartment was flooded.

Schichau, of Elbing, had also built torpedo-boats. In 1882 this firm built two boats for Italy of 100 feet and 40 tons, with a speed of 22 knots. The armament was two torpedo-tubes and a revolving-cannon.

The torpedo-boat had grown precariously to this stage in its existence. It had had its ups and downs, but through the exertions of builders and of officers who had faith in its mission, it had continued to develop.

It started off very well about the time the automobile began to displace the spar torpedo, and it was no longer necessary for the attacking boat actually to reach the side of the enemy. A very ordinary automobile torpedo had evidently many advantages over the spar-torpedo. But the revolving-cannon and the rapid-fire gun made their appearance, and in the then development of both torpedo and launch, the balance between attack and defense was, if anything, more than restored. The search-light and the defense-net capped the climax in favor of the defense.

But the torpedo continued to improve in speed and range and the torpedo-boat in size and speed. In fleet exercises and drills the boats occasionally scored successes, notwithstanding the search-lights, rapid-fire guns and defense-nets. We have followed the progress of the boat; the torpedo had kept pace with it. From a speed of 6 knots in 1867, it had increased to 20 knots in 1876, and to 24 knots in 1882. The range had also increased with the speed.

The torpedo-officers remained unshaken, enthusiasts they were called by their opponents, but it is worth noticing, however, that the enthusiasm came from a practical knowledge of the weapon, and represented the balance to the good after discounting uncertainties and failures.

But the boats were again to fall into disfavor. They were still small compared with those of to-day. Their endurance in coal, water, and provisions was limited; they were barely seaworthy; and, through buffeting, their crews were rapidly exhausted when cruising continuously in all weathers. Then, with their light and fast-moving machinery, breakdowns were numerous. The boats were sources of anxiety to the Admirals in command, and frequently had to be sent to port under convoy.

From now on, through this part of the subject, an attempt will be made to indicate the trend of opinion by a selection of quotations coincidently with a brief enumeration of the various types of boats as they appeared.

The firm of Normand & Co., of Havre, had built some of the French boats of 1878. In 1883 they built the Poti for Russia. She was 125 feet long and displaced 72 tons. She made 18½ knots on 570 horse-power. Her armament was two tubes and two revolving-cannon.

Between 1883 and 1890 the Elbing firm built sixty-three boats for Germany, now on the navy list, of from 121 to 128 feet, and 85 to 88 tons. On 1000 indicated horse-power they made from 19 to 22 knots. Their armament is two torpedo-tubes and two revolving-cannon.

Mr. J. S. White, of East Cowes, was the originator of the turn-about system of boats. By cutting away the deadwood aft and sometimes fitting a second rudder under the bow, he increased the manœuvering power considerably. One of the best known of his boats was the Swift for the English government in 1885.

She was 150 feet long and displaced 125 tons, quite a large boat for her day. She was sometimes referred to as a torpedo-catcher. Her trial speed was 20.8 knots. She had a three-cylinder compound engine and two locomotive boilers. The armament was two torpedo-tubes and six 3-pounders.

The Adler and Falke, by Yarrow for Austria in 1885, were the fastest boats to date. They were of 135 feet and 95 tons and made 22.4 knots on 1250 horse-power. This speed was probably exceeded at times, for Yarrow's boat for Italy in 1882 was credited with 22½ knots. The armament of the Adler and Falke was two bow tubes and two Nordenfelt guns. *Engineering*, January, 1886, page 14, has the following: "The bow of these boats is specially strong, the maximum weight of metal being put forward so as to stiffen the boat for ramming."

In this year and the next (1885-6) Thornycroft, White and Yarrow built fifty or sixty boats for England, varying from 113 to 128 feet, and from 60 to 75 tons. Their maximum speed was 22 knots. They carried two 3-pounders and from one to five torpedo-tubes. Lord Brassey states in the Annual for 1886, page 83, that these boats, which were laid down at the time of the Russian war-scare, were intended for use in the Baltic. It was expected that the Russian ships would be found locked up in port where torpedo-boats could not get at them, but that the English ships would be subject to attacks by the Russian boats. Hence these boats would probably have gone out with gun armaments alone, to act as a protection to the fleet against the Russian torpedo-boats. This idea anticipated by several years the modern torpedo-boat destroyers, which are really large and fast torpedo-boats with a heavy gun armament.

A suggestion to the same effect, but of a much earlier date, was made in a letter to the London *Engineer*, April, 1878, page 296, signed "Engineer." It was there advocated that each battleship should be protected from torpedo-boats by a small fast vessel of not less than 20 knots speed, with a sharp bow strengthened for ramming, and mounting a single bow-chaser. This vessel was to circle around the battleship at a distance of 500 yards and run down or destroy by gun-fire any hostile boat that might be encountered.

The following is the decision of the British Admiralty Board in regard to torpedo-boats, after the manœuvres of 1886, as quoted in Brassey, 1887, page 514:

"The practical tests during recent evolutions imposed upon first-class torpedo-boats, that is, boats intended for open sea service, and upwards of 100 feet in length, have shown that they could not, in actual warfare, stand the strain of the daily wear and tear to which they might be exposed. The discomfort and hardships which their crews have to endure in rough weather, the loss of speed to which, after steaming a certain number of hours at full pressure, they are subject, owing to the tendency of their necessarily contracted boiler tubes to choke, disqualify boats of these dimensions from taking the prominent part in warfare in the open seas which their adherents claim for them. The Board have therefore decided in future to build for sea-going purposes vessels of larger dimensions, capable of acting both on the offensive and defensive in torpedo-warfare, in the open sea. These vessels to be of the Rattlesnake type, capable of maintaining for many hours the initial speed of the ordinary torpedo-boat, armed with quick-firing guns, and another gun of a larger calibre, and affording adequate accommodations and protection to the complement they carry for sea-going purposes.

"The Board have decided upon adopting a new type of second-class torpedo-boat, capable of being lifted on board ships of a certain displacement, and which would be carried by the ship for service in the place of the larger or first-class torpedo-boats which are now supposed to accompany a squadron.

"The 125-foot torpedo-boats now building or built have, in most instances, been allotted to the defense of the great military ports and coaling stations, where they will remain."

We see here the line of argument that led to the torpedo-gun-boat or torpedo-boat catcher. The decision in regard to the 125-foot boats is scarcely open to criticism. Boats of that size must necessarily operate from a near-by base, which they can seek for shelter from the weather, or when pursued by the enemy, or to complete stores.

The decision as to second-class boats was apparently a retrogression. The weight of opinion then and now was opposed to them, and for reasons which were well stated the previous year by *Engineering* (December, 1885, page 616):

"It would seem as if second-class torpedo-boats have become a thing of the past, so far, at least, as building any fresh ones is concerned. It is a question whether so small a class as a 60-

foot boat could ever be used effectively against an enemy excepting under the most favorable conditions. In addition to this the second-class boats are useless for any general purposes in times of peace, and occupy a vast deal of space on board the vessels that carry them. The great improvements in speed made lately by the larger navy pinnaces have made the second-class boats less necessary, as the pinnaces carry torpedoes and are a far handier and more seaworthy style of craft; useful also for general purposes as a ship's steam launch."

The French at this time (1886) were building the Balny class, so-called sea-going torpedo-boats (*torpilleurs de haute mer*) of 135 feet and 70 tons, armed with twin bow tubes and two revolving-cannon. They were designed for 22 knots.

A since celebrated boat of that day (1886) was the Kotaka by Yarrow for Japan. She was 170 feet long and displaced 190 tons. With 1400 indicated horse-power she made 19 knots. She carried six torpedo-tubes and four machine guns. This boat is one of the largest of the torpedo-boats proper, and in size could be classed as a destroyer. She is very completely subdivided and is protected by 1-inch plates over the machinery space. In company with other boats, she was under the fire of the forts in the attack on Port Arthur and suffered less than any.

In 1886 Messrs. J. & G. Thomson, of Clydebank, Glasgow, built the Wiborg for Russia, of 142 feet and 142 tons, armed with twin bow tubes and a training tube on deck for 19-foot torpedoes, and two revolving-cannon. Her speed on trial was 20.6 knots. This vessel embraced a number of novel features, among them ¼-inch plating on the bow, and an inner skin in wake of the water-line forward, with cellular spaces to be filled with an obturating substance. The attack was to be bows-on, to take advantage of the protective features. After the discharge, the vessel was to back off at full speed. The stern rudder was of a form suited to this use, and there was a second rudder under the bow. She carried 45 tons of coal, sufficient to steam 4000 miles at 10 knots. She was one of the first twin-screw torpedo-boats.

The Russian boats Revel and Sveaborg were built by Normand at this time (1886). They were 152 feet long and displaced 96 tons. With about 800 indicated horse-power they made 22 and 19.7 knots respectively. They had a very good

coal capacity for their horse-power, 30 tons, and were considered very effective boats. They carried two torpedo-tubes and two rapid-fire guns.

In 1886 Schichau sent out a 144-foot boat to China under her own steam. She had twin bow tubes and four machine guns. The speed was 24.2 knots for one hour on 1597 indicated horse-power. The coal endurance was 3000 knots at economical speed.

In 1887 Yarrow built No. 80 for England. She was 135 feet long, with 105 tons displacement, 1540 indicated horse-power, and a speed of 23 knots. She carried five torpedo-tubes and four 3-pounders. She was in dimensions and performance a close approach to our Cushing.

His two boats for Italy the same year were quite similar, but made 25.1 knots, the then highest speed.

Two weeks later, the Ariete for Spain, by the Thornycrofts, made 26.1 knots, exceeding Yarrow's boat by a knot. She was 148 feet long, of 97 tons displacement and 1600 indicated horse-power. She was fitted with twin bow tubes and carried four 3-pounders. This boat exemplified all the main features of the Thornycroft construction. She had tubulous boilers, and patent double rudders outboard of the screws. The stern was flat and hollowed out underneath to give a good run of water to the screws, and to prevent squatting.

The same firm built the Coureur for France in 1887, a boat of 148 feet and 120 tons, with a speed of 23½ knots. She was regarded as a very efficient type and showed excellent sea-going qualities.

The following are extracts from the report of the Committee on Naval Manœuvres, 1888, Admiral W. M. Dowell, Chairman, as quoted by Brassey, 1888-9, page 416:

"As to 'The value of torpedo-gunboats, both with the blockading and blockaded fleets, and the most efficient manner of utilizing them.'

"Torpedo-gunboats of high speed and good coal capacity would be of incalculable value to the blockading fleet, but torpedo-boats of any class at present in use would be of far more value to the blockaded squadron than to the blockaders. Torpedo-boats, if not capable of keeping the sea independently, under all conditions of weather, would inevitably prove a cause of embarrassment and anxiety to an Admiral commanding a blockading fleet, and would be subject to endless casualties.

"First-class torpedo-boats might, with advantage, accompany a fleet if carried in a specially constructed vessel—superior class of Hecla—provided with suitable hydraulic cranes for hoisting them in and out.

"Second-class torpedo-boats, as carried in the ironclads, will, no doubt, prove useful on occasions.

"We consider, however, the new type of Vedette-boat preferable for sea-going battleships; they are better sea-boats and, being built of wood, are less liable to damage and more easily repaired than torpedo-boats.

"The balance of opinion, in which we concur, is to the effect—

"That the employment of torpedo-boats as an inner line of blockade is not desirable, they being calculated to cause much confusion and embarrassment to their friends. That they are admirably adapted for purposes of defense; but even then, without a very simple and perfect system of signals, they are liable to be taken for enemies by their own side. The documents before us show that this actually occurred once at least on each side in the course of these manœuvres.

"That torpedo-boats should not be used as despatch-vessels, or for any purpose other than that for which they are designed.

"That torpedo-nets—certainly as at present fitted—cannot be carried by vessels under weigh without impairing their efficiency and compromising their safety."

The Aquila class for Italy were built by Schichau in 1888. They were 152 feet in length and displaced 130 tons. On 2200 indicated horse-power the Aquila made 26.6 knots. The armament was three torpedo-tubes and five rapid-fire guns and revolving-cannon. The class was reported to have turned out badly in the manœuvres of that year. Strength, seaworthiness and comfort were all sacrificed to speed, which was greater than in the 128-foot type only in smooth water. This is a lesson always to be borne in mind in attempting to get more speed than the displacement and offensive features warrant. The smaller type was reverted to for awhile in Italy, though some larger boats are now proposed.

The following is from the Parliamentary Report on the English Manœuvres of 1890, as quoted in Brassey, 1891, page 26:

"The radius of action of a torpedo-boat is limited less by her coal and feed-water supply than by the physical endurance of

her crew, especially of her commander. It has been assumed that the physical strain caused by continuous attention to the navigation of a boat at night cannot be supported for more than a very few hours, if the officers undergoing it are to arrive on the scene of operations still so unwearied that neither nerve, nor coolness, nor readiness of resource would be likely to fail them at a critical moment. During the late manœuvres it was proved by actual experience that there are officers who can navigate their boats for hours together across a crowded route, can reach their objective punctually at the prearranged time, and can then manœuvre at very high speed at night in an anchorage so filled with shipping that manœuvring in it when fresh and in broad daylight would require much care and attention. . . . A result of the 1890 manœuvres is, that opinions on the effective radius of torpedo-boat action will have to be reconsidered."

In 1890 Thornycroft built two very effective boats for the Argentine, the Murature and Commodoro Py. They were 150 feet long, of 110 tons displacement, 1500 indicated horse-power, and made 24½ knots. The armament was three torpedo-tubes and three 3-pounders. The Murature, on the trip out, steamed from Pernambuco to La Plata, 2300 miles, at 9½ knots with one engine, without stopping. The radius of action under these conditions is 2800 miles.

The Adler (1890), a Schichau boat for Russia, was of the Aquila type. She made 27.4 knots on trial and 26.55 for two hours. This was the highest speed to date.

Our own Cushing was launched by the Herreshoffs the same year. She is 138 feet in length, of 106 tons normal displacement, and 120 tons loaded. Her best speed was about 24 knots on the measured mile, and trial speed 22½ for three hours. This last was on 1720 indicated horse-power. Her armament is three torpedo-tubes for the short 18-inch Whitehead, and three 1-pounders. She has the exceptional bunker capacity of 39 tons, or 51 pounds per indicated horse-power, which is equivalent to a day's steaming at full spead. This feature of coal endurance is a most valuable one and will be referred to more at length in another place. She has at all times proved exceedingly safe, reliable and effective. Her sea-qualities could be somewhat improved by removing the bow torpedo-tube and building her higher forward with the weight thus saved.

Brassey's Annual, 1891, page 110, has the following:

"Experience has shown that the smaller torpedo-boats are unseaworthy. Those recently constructed in England are of about 100 tons displacement. Germany, Italy and Russia are building boats of 130 to 160 tons. It will probably be well to have torpedo-boats of two classes. The first class, of not less than 150 tons, should be able to cruise with the fleet within a certain distance from the coast. The second-class boats, for harbor defense, may be of small size and cheap construction. In the conditions which favor the attack by the torpedo-boat upon heavy ironclads blockading a port, a small and cheap type will be almost as effective as one more costly."

This last view is open to argument. The subject will be presented again when the different types of boats are discussed.

The Annual of the Office of Naval Intelligence, 1892, page 256, has this in regard to the French manœuvres of 1891:

"The most important lesson of the manœuvres, and one that has caused a deep impression, is the fact that the torpedo-boats were unable to follow the battleships at a speed of 12 knots even in moderate weather. Their small storage of coal and water, the excessive fatigue imposed on officers and men, when sleep and rest are out of the question, the impossibility often of cooking, make it necessary to resupply them and to change their crews every three or four days. The manœuvres have proved again that torpedo-boats are not fit to be attached to a squadron on a permanent footing; if it should go to sea for more than three or four days they cease to be an additional strength, but become a worry and an impediment. On the coast they have lost none of their importance; while they remain within reach of shelter, where they can be provisioned and coaled and their crews can rest, they are of the greatest value against hostile cruisers."

The boats referred to were one of 108 feet, two of 118 feet, and the remainder of 133 to 139 feet. These last boats ought to have given a better account of themselves. Still it is not a type to attach permanently to a squadron. We shall see later that a decidedly larger boat is desirable for such use.

In 1891 Thornycroft built three boats for Brazil of 150 feet and 150 tons. They had twin-screws, protected by double rudders outboard and a guard underneath, and the usual flat, hol-

lowed-out stern. They had two bow tubes and two single deck tubes on the middle line, all for 14-inch torpedoes. They were guaranteed to make 24 knots for two hours on 200 pounds of steam. This they exceeded, one having made 25.4 for two hours, but with 210 pounds of steam. The gun armament was out of keeping with the size of the boat—two 1-pounders.

Captain Eardley-Wilmot said, in discussing a lecture before the Royal United Service Institution by Mr. Laird Clowes in 1892:

"I quite agree with the lecturer when he says a torpedo-boat should not be looked upon as a portion of a sea-going fleet, although I think there is a tendency rather to make too much about the hardships and impossibilities of existence on torpedo-boats, because last year when the French squadron arrived at Portsmouth Harbor they had two torpedo-boats accompanying them, which the Admiral stated had been with him for six months, and had been served all through the cruise by the same officers and men, and that he found, after the first month or two, they had gradually accustomed themselves to the life."

The Corsaire, built for the French government at St. Denis in 1892, may be taken as the starting point of the present large, high-speed, sea-going torpedo-boats in vogue in that country. She is 160 feet long and displaces 150 tons. On 2500 horse-power her speed is 25½ knots. She carries two tubes for the long 18-inch torpedo, mounted on the central line and pivoting on either broadside. Her gun armament is four 1-pounders. Her coal capacity is 15 tons, which at two pounds per indicated horse-power per hour, would last her less than seven hours at full speed. This is a very limited coal endurance. As the indicated horse-power and speed are not high for a boat of that size, and the armament is not excessive, the design must be faulty; or there must be other and unnecessary weights.

In making these comparisons of coal endurance, the figure two pounds per indicated horse-power per hour *at full speed* has been taken as a basis. This is too low in most cases and makes the endurance too high. Schichau, I believe, has a record of 1.54 pounds for the Russian torpedo-gunboats Posadnik and Woewoda on their forced-draught trials in 1893, while Normand has a record of 1.86 pounds for the Forban. The English destroyers are required to conform to 2½ pounds under penalty

of a tax in the form of an added quantity of coal to be carried on trial. In the tables herewith there is a column for total pounds of coal carried per indicated horse-power, which, divided by the performance of the particular boat, will give the true endurance, subject to errors in the data, which may not always have come from reliable sources.

I may say in this connection that data in regard to torpedo-boats are very hard to get. The most reliable tables I know of are those given in the Naval Pocket-book of Mr. Laird Clowes, to whom I am indebted for a great deal of the information here used.

Our Ericsson dates from this time (1892). While this boat, through various unfortunate accidents, has not yet been commissioned (December, 1896), she is, as far as dimensions and power are concerned, a very perfect type of first-class torpedo-boat to operate from a shore base. She is 150 feet long, displaces 120 tons, and is to make 24 knots on 1800 horse-power. Her coal capacity is 40 tons, equivalent to 25 hours at full speed. The armament is three tubes for the short 18-inch torpedo and four 1-pounders.

The Pedro Ivo class for Brazil were built by Schichau in 1892-3. They are of the Aquila type. They crossed the Atlantic under their own steam, making the run from St. Vincent to Pernambuco under one boiler at 12 knots. They took part with the Sampaio in the attack on the Aquidaban in April, 1894, though they did no execution with their torpedoes.

In the Naval Intelligence Annual for 1894, page 57, is described the sea-test of two German torpedo-boats, S. 68 and S. 69, in February, 1894. They were boats of 144 feet and 110 tons (intermediate between the Cushing and the Ericsson) and were sent to sea from Wilhelmshaven in a gale of wind. There was a heavy swell and the wind was logged as 10 to 11. The boats behaved splendidly, kept up to the wind, lay-to, and ran before it at 16 knots with little racing. They were perfectly seaworthy and were not injured.

While the above speaks well for the boats, there is no certainty the crews could have stood such weather for long on a stretch.

The following are extracts from the official report on the English Manœuvres of 1894, as quoted in the Naval Intelligence Annual for 1895, page 194:

"The torpedo-boat operations were upon a too restricted scale to supply much valuable instruction, but as far as they went they tend to confirm the view that the most effective employment of the torpedo-boat in war will be limited to sending her to attack an enemy's ship in a known position within the boat's range of action, and that the whereabouts of the enemy must be first ascertained and be communicated to the commander of the boat. The necessity of combining with torpedo-boats vessels of other and larger classes to scout and discover the enemy, when exact information as to his position cannot be obtained by other means, seems to be established, and, if so, it carries with it the obligation to consider a mere flotilla of torpedo-boats by themselves as a belligerent factor of distinctly imperfect efficiency."

The Normand boat Chevalier for France was launched in 1893 and completed in 1894. She is of 144 feet and 118 tons. She has two Du Temple boilers in the same compartment, twin-screws, and made 27.22 knots on trial. Her horse-power is 2700, and coal consumption at full speed 1.99 pounds per horse-power. There are two 18-inch torpedo-tubes on the middle line and two 1-pounders. A novelty in the arrangement of the screws is that one is a little in advance of the other, permitting the blades to overlap. They were made to revolve in the same direction, with the idea of giving better water to the inner blades; but at high speed the boat has a decided list, due to the reaction, a feature which is of course not desirable.

In 1893-5 there were ten new boats built for the English government by Yarrow, Thornycroft, White and Laird. They varied from 140 to 142 feet, 100 to 130 tons, 1400 to 2700 horse-power, and 21 to 24 knots. Their coal capacity was 18 to 26 tons, equivalent to about 14 hours full speed for the lower horse-power and 11 hours for the higher. This is greater than in contemporary French boats, but seems inadequate to the objects to be attained, of which more later. These are the latest English boats, exclusive of torpedo-boat destroyers.

The Forban has become very celebrated by her high speed on light displacement. She was built by Normand for France in 1895 and displaces 130 tons on a length of 144 feet. Her indicated horse-power is 3250 and speed 31.2 knots. The armament is two 14-inch torpedo-tubes and two 1-pounders. Her

bunker capacity is 15 tons, equivalent to an endurance of 5½ hours at full speed, allowing 1.86 pounds per horse-power, which was her performance on trial. Her tremendous horse-power and speed are thus accounted for. On a given displacement, speed, endurance, and armament contend; and one predominates only at the expense of the others. A boat of her size should carry the long 18-inch torpedoes and several rapid-fire guns of at least a 3-pounder caliber. The coal endurance might with advantage be trebled. The relative value of speed, armament and coal will be discussed in another place.

On account of the interest attaching to this boat, a few more particulars are added. The speed as given above was made at 125 tons displacement. The load displacement is 136 tons. At 130 tons, with a load of 16 tons, including coal, equipment and armament, she made 31.03 knots for one hour. It is needless to say that the above allowance of weights is preposterous for a boat of 130 tons. From reliable information, the speed is gained not only by the sacrifice of weight, but also apparently at the expense of structural strength.

One of Yarrow's latest boats is the Viper for Austria, which has been delivered within a year. She is 148 feet long and displaces 120 tons. The guaranteed speed was 24 knots with 26 tons load. She really made 26.6 for three hours on 2000 indicated horse-power. The bunker capacity is 30 tons, equivalent to 17 hours' endurance at full speed. She has only a single screw, which naturally impairs the handiness and offers greater chances for disablement. Otherwise, she is in her main features an excellent type of first-class torpedo-boat.

The United States has in course of construction fifteen torpedo-boats and one destroyer. Their principal features appear in the tables. Nos. 3 to 8 are intermediate in size to the two types which it will be seen later are thought to be desirable for our service. Their armament is light for their size, 1-pounders and short torpedoes. They would be improved by the substitution of 3-pounders and long torpedoes. Their displacement amply warrants this change.

Nos. 9 and 10 are copied after the Cyclone, a Normand boat of the Forban type slightly enlarged. The coal endurance at full speed will be about 8½ hours. The armament is to be four 6-pounders and three torpedo-tubes for the long 18-inch torpedo.

Nos. 12, 13 and 14 ought to be valuable boats. They have a heavy torpedo armament and a light gun armament. Perhaps it might be advantageous to substitute 3-pounders for the 1-pounders, saving the weight necessary by omitting one of the three torpedo-tubes. Two tubes for the long 18-inch torpedo and four torpedoes make a very fair armament for a first-class boat.

Nos. 15 to 18 are too small for general use, but are warranted by considerations of inland-water navigation and length of canal locks.

The above opinions are the result of a consideration of the relative values of speed, size, coal endurance and armaments in torpedo-boats, and anticipate a discussion at some length that appears later.

Location of Tubes in Torpedo-boats.

A number of methods of mounting tubes have been mentioned. The bow tube with steam, air or gunpowder impulse was the most common until recently. In some cases there were two of them side by side, referred to as twin tubes. This method answered fairly well when the speed was not so high as at present. Now the tube in the bow makes the boats wet in a sea-way, and it could scarcely be used except in smooth water. At high speeds there is also danger of overrunning the torpedo should it not attain its own speed quickly. By omitting these tubes, enough weight is saved to build up the bow forward and improve the sea qualities.

Tactically, the bow tube, requiring to be pointed by the helm, is not so desirable as a pivoted tube with a large angle of train. Then, too, in approaching the enemy at high speed, it is awkward to have to stop and back, or else make a wide sweep, during which the boat's broadside becomes the best possible target for the enemy. With pivoted tubes, the boat can begin the turn before delivering the first torpedo, and with a small helm can launch in succession all that will bear on one broadside, and then putting the helm hard over, can soon be out of danger.

Other methods for getting the torpedo away have been by side dropping-frames, usually from the smaller boats, already described; then from turn-table tubes on deck, singly or in pairs.

Pairs of tubes on the same turn-table have sometimes been set at a small divergent angle, with the idea of launching both torpedoes together and thus increasing the chances of hitting. They have also been laid with their muzzles in opposite directions, to permit of discharge on both broadsides. Sometimes, also, they have been mounted on racers revolving around the conning towers.

The objection generally to pairs of tubes training together is that it may not always be desired to launch both torpedoes together or on the same bearing. If one only is launched on a given bearing, it may be awkward under fire, or there may not be time to train again before the second torpedo is required. Then, too, it is desirable to have the option of training either tube separately on either beam, or both tubes on the same beam, and possibly at different angles. This cannot be done with any form of double turn-table mount.

Single tubes have been mounted near the side of the boat and on the central fore-and-aft line, in the last case with train on both beams; also on top of the forecastle and near the stern, in both positions with a large angle of train on both sides of the keel line.

Single tubes at the side are exposed to the sea, especially in the turtle-back form of construction, and in consequence it would not be advisable to install other than the smaller torpedoes in these positions. The advantages are a larger command of fire *on one broadside*. In a small boat the short tube could very well be pivoted amidships, and while thus better protected from the sea, would command a fair train *on either beam*. As the spoon is in addition to the half length of tube forward of the pivot, it reaches well over the boat's rail on whichever side it is trained.

The position on top of the forecastle, while excellent in smooth water, is open to the objection of carrying the weights high, which in itself is bad in a sea-way. Moreover, the exposed position is bad for the torpedoes on account of salt spray, and the tubes would be hard to serve with much motion on.

The stern position is also good tactically, and is not open to objections on account of weather. If, however, the torpedoes are stowed for long in tubes in this position they are affected by the vibrations due to the propellers, which are here at a

maximum. If they can be stowed in other positions this objection is partially removed. On the whole, it is considered best to locate the tube where the torpedo can be kept loaded, charged and adjusted, ready for use at any time.

This reasoning points to the desirability, as a general rule, of installing the torpedoes in single tubes pivoted on the central fore-and-aft line, and at some distance from the ends of the boat. In the case of small boats, the short torpedo would be permissible, as the boat's beam would not be great enough materially to reduce the angle of train, were it not that as a type it has not been found sufficiently accurate to warrant its farther manufacture. It has been generally abandoned abroad. The standard torpedo for torpedo-boats is the long 18-inch, on account both of its greater accuracy and its larger explosive charge. While the weight is less than 30 per cent. greater than that of the short 18-inch, the gun-cotton charge is over 83 per cent. greater. The greater accuracy is due simply to its greater length, 16½ feet against 12. Two or three tubes may be carried, according to the size of the boat. The end of the spoon is 11 to 12 feet from the pivot, which takes the torpedo well clear of the side of even a large boat. By having a torpedo-carriage with the pivot towards the breech rather than the muzzle, the sweep of the spoon could be still farther increased, and angles of train exceeding 90 degrees obtained on each broadside of a boat of 20 feet beam. If a lighter torpedo is required, as for the side dropping-frames carried by vedette-launches, the long 14-inch torpedo is considered far preferable, by reason of its greater accuracy, to the short 18-inch. The explosive charges are about the same.

Smokeless powder will probably replace all other means of discharge. Air and steam require extra weight and are otherwise complicated. They are already practically replaced by gunpowder. This affords a simple means of discharge, but the pressures vary greatly with dampness. Smokeless powder gives more uniform pressures, is practically unaffected by dampness, and does not foul the tube.

Miscellaneous Torpedo-vessels.

The building of torpedo-vessels other than fast launches and torpedo-boats was preceded by one or two tentative types before the lines were definitely determined. Thus in 1874 the English

launched the Vesuvius, which was called a torpedo-ship. She was built of iron and was 90 feet long with a displacement of 245 tons and a speed of 9.7 knots. Her armament was four submerged tubes for Whitehead torpedoes. With twin screws and coke for fuel, and the products of combustion arranged to be discharged from side holes in horizontal flues, she was intended to be handy, smokeless and noiseless. Her speed was deficient.

The Italian Pietro Micca dates from 1876. She was built of iron, was about 200 feet long and of 550 tons displacement. There was an armor deck 10 inches below the water-line with sloping sides heavily plated with steel and iron. The intended speed was 18 knots, but she did not realize over 14. She was fitted with two submerged tubes and carried ten torpedoes, besides two machine guns. She was filled with machinery and had four boilers.

The Swedes built the Ran in 1877, subsequently called the Drott. She was a twin-screw iron ship of 175 feet and 630 tons, and had a speed of 13 knots. The armament was three torpedo-tubes, one submerged, and four rapid-fire guns. She was fitted also for the Harvey torpedo.

Rather a remarkable vessel of her day was the Danish armored torpedo-ship Tordenskjold, 1880. She was a steel, twin-screw, turtle-shaped vessel, with a 3.7-inch armored deck and an 8-inch armored barbette. Her length was 222 feet, displacement 2400 tons, speed 14 knots. She had a cellular double bottom surmounted by an inner ship of forty cork-filled compartments. Above this were the armament, torpedoes and crew space. There were four torpedo-tubes, over-water, five Krupp guns of from 12 to 30 centimeters caliber and eight machine guns. She carried in addition two torpedo-boats.

A somewhat similar vessel, guns excepted, was the English torpedo-ram Polyphemus, 1881. She was a twin-screw, steel, turtle-back vessel of 240 feet and 2640 tons. Her best speed was 18 knots. The armament was five submerged torpedo-tubes, forty torpedoes, six 6-pounders and two machine guns. The steel deck was two to three inches thick. She was fitted with bow and stern rudders, and could take aboard water-ballast to sink her to just awash.

The above vessels were not reproduced, though there are possibilities in some of them. A fast armored torpedo-ram may yet

be in favor, as it is not difficult to imagine cases in which such a vessel, acting singly or with the fleet, would give more than a good account of herself.

Two other types of torpedo craft may be briefly discussed here, and the way will then be clear for the cruisers, gunboats and destroyers. These are the torpedo-dépôt-ship and the German division-boat. Their principal features appear in the tables.

Of the first, the Hecla was the prototype, a British merchant steamer taken into the service and fitted for the purpose. She was followed by the Japon, the Vulcan, the Pelikan and the Foudre. The functions of the dépôt-ship were to carry spare torpedoes and stores and a large number of second-class boats to hoist out when they should be of use. They were fitted with large repair shops, and could carry relief crews for the boats as well as medical officers and stores.

The division-boat acts as the flagship of a division of torpedo-boats. It carries also spare torpedoes and stores, relief crews, medical supplies, and is fitted with repair shops, all naturally to a more limited extent than in the case of the dépôt-ships. It can be used as a scout for its division, and to a certain extent as a torpedo-boat destroyer. While these boats are about the size of the destroyers, they have not their lines or build, and the earlier ones did not have the speed. In one important feature they are very different. Their draught is 10 to 12 feet, nearly double that of the destroyers, and they are, therefore, incapable of following torpedo-boats into shoal water.

It is doubtful if either of these types can be of much value in the future. It has become apparent from the citations already made in reviewing the progress of torpedo-boats that the day of the second-class boat is perhaps past, and that first-class boats are at their best when operating from shore bases. The independent duties of the division-boats can be performed by the regular scouts or by the destroyers. Their stores and supplies will not be required by the torpedo-boats, for they will seek their own bases to renew their supplies and rest their crews; and the destroyers are capable of taking care of themselves equally with the division-boats.

The utility of the torpedo dépôt-ship disappears by the same reasoning. It may be desirable to fit up a large vessel as a floating repair shop for the whole fleet, and send her where she

is most needed. The steamer Ohio, of the International Navigation Company, was to have been so fitted had we gone to war with Chile in 1892. The French Superior Council has reported against the use of the Foudre as a dépôt-ship. Plans are under discussion to convert her to a cruiser.

Torpedo-cruisers.

The immediate predecessors of the torpedo-cruisers seem to have been the fast despatch-vessels which were in vogue ten to twenty years ago. The Zieten was a torpedo and despatch-vessel built by the Thames Iron Works for Germany in 1876. She was a twin-screw iron vessel of about 200 feet and 1000 tons, with a long, low hull, and bow and stern torpedo-tubes six feet under water. The designed speed was 16 knots. She carried lately 10 machine guns.

The Staffeta, built by the Italians at the same time, was 253 feet long and displaced 1388 tons. Her speed was 14 knots. She had one torpedo-tube, four 12-centimeter guns and a number of smaller ones.

The German Blitz and Pfeil, 1882, were much the same. They were twin-screw steel vessels of 246 feet and 1382 tons. Their maximum speed was 16.3 knots. Their armament was one submerged tube, besides rapid-fire and machine guns.

The Alacrity and Surprise, built by the Palmers for the English government in 1885, were purely despatch-vessels, but they gave by their lightness and speed a suggestion of possible torpedo use. They were twin-screw steel vessels of 250 feet and 1600 to 1700 tons. They made upwards of 17 knots with forced draught. The Alacrity was armed with ten 6-pounders and two machine guns. It will be seen how opinion is reverting to this style of armament for vessels of this type to the exclusion of torpedoes.

Next came the English Curlew and Landrail in 1885-6. They came very near the eventual torpedo-cruiser, but they were too small and too slow. They were twin-screw steel vessels of 195 feet and 950 tons, with a speed of 14½ knots. Their armament was a number of 5-inch and 6-inch breech-loaders, besides rapid-fire and machine guns, and three torpedo-tubes. Thus it is seen the torpedo is beginning to assume prominence

At the same time the Armstrongs were building the Leopard and Panther for Austria. They were 224 feet long, displaced 1530 tons, and had a speed of 18½ knots. They carried four torpedo-tubes in addition to a numerous gun armament. They were built with a high poop and forecastle for weatherly considerations and were much subdivided.

In the English Scout and Fearless, 1885-6, the typical torpedo-cruiser was reached. Subsequent steps have been retrogressive, at least as regards the torpedo features. They were about the size of the Leopard, but had scarcely more than half the horse-power. They were loaded down with both guns and torpedoes. They were 220 feet long, displaced 1580 tons, and steamed 16.7 knots. They carried originally eleven torpedo-tubes, one of which, in the bow, was submerged. Four have since been removed. The gun armament consisted of four 5-inch and eleven rapid-fire and machine guns. The type was intended to keep the sea in all weathers and afford comfort to the crew. They were designed as a result of the shortcomings of torpedo-boats proper, and were referred to in the prints of the day as sea-going torpedo-boats.

The French contemporaries of these vessels were the Condor and her class, the Epervier, Faucon and Vautour. Their design really preceded the English ones, but they were longer in building. They were 217 feet long, displaced 1240 tons and made nearly 18 knots. Their armament was five torpedo-tubes, and five 10-centimeter guns, besides rapid-fire and machine guns. The upper deck was turtle-backed the whole length; there was a 1½-inch steel deck, a splinter deck, a double bottom, and a cellular water-line belt. They had compound engines and four locomotive boilers.

A number of other vessels of this type followed in different countries, but it is not necessary to describe them here. Particulars of some of them are given in the tables. The English Archer, a slightly enlarged and modified Scout, and the American copy, the Yorktown, exemplified the type in the essential features. The German Greif (1886) and the Italian Coatit (1896) are the fastest of any of them, having been designed for 23 knots.

This class of vessels, as torpedo-cruisers proper, have not proved a success. They were intended to chase and destroy torpedo-boats, as well as to engage large ships with their torpe-

does. They were loaded with guns, men, torpedoes and machinery. The fastest of them can catch torpedo-boats proper in deep water and in a sea-way, but they cannot follow them into shoal water. It is hard to understand in what way they were intended to use their torpedoes. They are too large to make a surprise attack. They have guns heavy enough to engage much larger and heavier vessels, but they would not dare to come near enough to use them. Stripped of their heavy guns and torpedoes, they would make very efficient scouts, especially the later and faster ones. They could carry a very numerous armament of medium-weight and light rapid-fire guns. In France this re-armament is already taking place, and markedly in the class of torpedo-gunboats, as we shall see later.

TORPEDO-GUNBOATS.

In the early days of the torpedo, the generic title of vessels expressly fitted for its use was torpedo-vessel or torpedo-ship. As the type developed, differences began to appear. Several comparatively slow vessels of various sizes retained the original name. Some of them have been described. The larger ones of moderate speed were known eventually as torpedo-cruisers, with an intermediate stage of despatch-vessels, as has been shown; and the smaller ones came to be called torpedo-catchers, and finally torpedo-gunboats.

The eventual French names of the various types, in order of size, may be given here as follows: *Croiseurs-torpilleurs, avisos-torpilleurs, éclaireurs-torpilleurs, torpilleurs de haute mer, torpilleurs-garde-côtes, torpilleurs-vedettes.*

The Austrians were the first in the field with gunboats by several years. Their Spalato and Zara, dating from 1879, were twin-screw steel vessels of 180 feet and 840 tons, with a speed of 14 knots. Their armament was a number of small caliber breech-loaders and machine guns, and two torpedo-tubes. They had a protective deck and high-speed compound engines supplied by locomotive boilers. In these regards they marked a decided advance in construction, but the speed was a disappointment.

The Sebenico (1882) and the Lussin (1883) were of the same displacement, but were slightly longer. The speed was the same. The Lussin had two 6-inch guns, besides smaller ones, and two torpedo-tubes.

The French Bombe class (1885-6) were, however, the pioneers of the typical torpedo-gunboat. The duties of this type may be summarized as follows from the Annual of the Office of Naval Intelligence, 1891, page 415: The tactical use of the torpedo-gunboat is to destroy torpedo-boats before the latter can reach the ironclads of the fleet; to cruise inside the blockading fleet and to give warning of the enemy's movements; cruising with the fleet to act as scouts, engage similar vessels, support torpedo-boat flotillas; to attack the enemy's squadron at night or force a blockade; and to undertake the duties of a high-sea torpedo-boat.

The Bombe class were twin-screw vessels lightly built of steel, 197 feet in length and of 395 tons displacement. Their speed was 18 knots, which was made with 2000 indicated horse-power. They were fitted with a water-line belt of cellulose. The sides were turtle-backed. The original boilers were of the locomotive type. They have been changed in the Bombe for the d'Allest. Nine water-tight compartments were fitted. The complement was 63 officers and men. The armament was two torpedo-tubes in the bow and seven rapid-fire and machine guns. The vessels were handy, but the construction proved too light. They rolled a great deal and were wet and uncomfortable.

The English Rattlesnake dates also from 1886. She was built of steel with a half-poop and forecastle. The length was 200 feet, displacement 550 tons. She made 19½ knots on 2800 indicated horse-power. The armament was four torpedo-tubes, one 4-inch breech-loader and six 3-pounders. There were four locomotive boilers. This type was adopted by the Board on Construction to obviate the difficulties due to wearing out of crews and constant breaking down of torpedo-boats. They were also intended to overhaul torpedo-boats in rough weather. Their light draught would ordinarily safeguard them against torpedoes.

Subsequent English types have been merely developments of the Rattlesnake. They were the Sharpshooter class, 1888-9; the Alarm or Jason class, 1892-3; and the Dryad or Halcyon class, 1893-4. Their details are sufficiently given in the tables.

The Italians entered the field with the Folgore and Saetta, 1886-7. They were 186 feet long, displaced 377 tons, and made 20 knots on 2000 horse-power. They had four torpedo-tubes and seven rapid-fire and machine guns.

The first four of the Tripoli class followed that year and the

next. They were noted for their triple screws. They were much larger, reaching 845 tons and 230 feet. Their armament was five torpedo-tubes, one 4.7-inch and seven other rapid-fire guns. The speed was 20 knots on 3600 horse-power. The class has been substantially reproduced to the present time, except as to the triple screws, which were not repeated. The earlier vessels were too light and vibrated excessively. This has been corrected in later ones.

In 1886-7 Messrs. J. and G. Thomson built the Destructor for Spain. She was 193 feet long and displaced 458 tons. She made from 20 to 23 knots on 3800 horse-power, according to the load. She had four cylindrical boilers and 39 water-tight compartments, with each boiler and engine in a separate compartment. She had complete coal protection and a curved 1¼-inch steel bulkhead forward. She was cut away at the ends for manœuvring and had a bow rudder. The masts were hinged to lower. The armament was five torpedo-tubes, one 9-centimetre gun, and six rapid-fire and machine guns. She, like the Wiborg, was built for head-on attack.

It is not necessary to go farther with the descriptions. The class as such has never proved satisfactory. The size has been continually increased in the endeavor to make the vessels fast, habitable and seaworthy, until the distinctive torpedo features have practically disappeared. They have never been equal to catching the best of the torpedo-boats, a duty now relegated to the destroyers. Scouting is therefore all that is left to them. By omitting their torpedoes, other qualities can be improved, such as speed, coal endurance, gun armament and ammunition.

The French have in great measure taken this view, and the order has been given to remove the torpedoes from all the class, a work now actually in progress. The boats, however, are still to be used as catchers. All of the intermediate types between cruisers and torpedo-boats are classed as *contre-torpilleurs* in the latest published lists. The more recent and fastest of them, with a numerous armament of light rapid-fire guns, should in addition make very efficient despatch vessels and scouts.

Torpedo-boat Destroyers.

The next type of vessel to be considered is the torpedo-boat destroyer. The genesis of the type has been fairly well indicated

in what precedes. The gunboats had been getting bigger and bigger, but had never been able to accomplish the object of their design, *i. e.* to catch torpedo-boats. It was decided, therefore, to build a big torpedo-boat, with plenty of engine power, and to arm her with a large number of light guns. This departure has resulted very satisfactorily. Although the destroyer was designed primarily to accompany the fleet and guard it from torpedo-boats, it was soon seen that as a high-sea torpedo-boat itself, with a moderate armament of both guns and torpedoes, it was the logical solution of the very difficult requirements of the case. This curious feature is touched on at more length in another place. The name has been retained to designate the type, but it now only partially indicates the use to which such vessels may be put. High-sea torpedo-boat would perhaps be a better designation; for it is a very good rule that any boat should have a sufficient gun armament, in addition to her torpedoes, to engage vessels of her own size and to destroy any smaller ones, which would in fact constitute her a destroyer.

The Havock, the first of the type, was built by Yarrow in 1893. She was 180 feet long, displaced 220 tons, and steamed 26.8 knots on 3500 indicated horse-power. She had three torpedo-tubes, one in the bow and two on a turn-table on deck. The gun armament was one 12-pounder on the conning-tower and three 6-pounders distributed on deck. The lines of the vessel had all the characteristics of the torpedo-boat, such as light draught, full body, sharp bow and full stern, all on an enlarged scale. Forward was a high turtle-back extending to the after side of the conning-tower. She was divided transversely by thirteen bulkheads, and there were twenty water-tight compartments in all. The conning-tower was of ½-inch steel plates. The Havock's boilers were of the locomotive type, though her sister-boat, the Hornet, had tubulous boilers.

It is not intended to describe all of these boats. The size has increased to 210 feet and 300 tons, and the horse-power to 6000 or over, designed to give a speed of 30 to 32 knots. Some mention may be made of two or three of the most recent. The Sokol was built by Yarrow for Russia in 1895. Nickel steel was employed to lighten her construction. She is 190 feet long, of 240 tons displacement, and was guaranteed to make 29 knots on 4000 horse-power. She has triple-expansion engines and Yar-

row's straight-tube boilers. The armament is two single deck tubes for 16-inch torpedoes, one 12-pounder and three 6-pounders. On her official trial, with 30 tons load, she made 29.76 knots for three hours on 3700 horse-power with an expenditure of 2.1 pounds of coal per horse-power per hour. She made 30.28 on the measured mile with 4490 horse-power, the then fastest speed.

The Desperate has just been built by Thornycroft. She is 210 feet long and displaces 272 tons. She made 30½ knots on 5600 horse-power with a coal consumption of 2.49 pounds per horse-power. The load carried was 35 tons. She broke a crosshead last June, wrecking the cylinder and scalding a number of men. She was running at 30 knots and carrying 210 pounds of steam. Our No. 11 is an essential copy of this boat, and is to make 30 knots with the same trial load, that is, 35 tons.

A departure has been made by Yarrow in four boats for the Argentine, now about completed, of which the Santa Fé is the first. They are protected by ½-inch steel armor completely surrounding the engines and boilers. The speed is 26½ knots, which means a sacrifice of three knots or more as compared with the Sokol, a vessel of practically the same size by the same firm.

This question of armor for large torpedo-boats, while advocated by some authorities, is not generally regarded with favor. The thickness of the armor is scarcely sufficient to be of much protection in an attack on a battleship or large cruiser. Surprise is here the best defense; and if this is effected, armor will not be required. In an engagement with other boats, armor might be of service, but hardly at the sacrifice of speed. An important duty of these boats is to protect the fleet from torpedo-boats. Should they fail in this through insufficient speed, the armor would be worse than useless. Taken altogether, if there is any weight that can be spared after the requisite speed and coal endurance are secured, the best place to utilize it would seem to be in added guns and ammunition.

The Durandal is one of Normand's latest boats. She is 180 feet long and displaces 300 tons. She is to make 26 knots with a load of 85 tons, representing armament, ammunition, crew, equipment, coal, and stores. The armament is two torpedo-tubes on the central line, one 9-pounder, and six 3-pounders. The full bunker capacity is 100 tons. A peculiar feature of the boat is a flying grating deck, extending from the conning-tower

to within 30 feet of the stern, on which the torpedoes and guns are worked. In this boat M. Normand has remedied many of the defects noticed in the Forban type. If she meets expectations, she should prove very effective. As will be seen later, she comes very near a type that is recommended for use in our own service.

Lord Brassey, in the Annual for 1896, page 194, quotes a naval officer present at the 1895 manœuvres of the torpedo squadron as follows:

"The impression left in my mind by the manœuvres was that all the present types of torpedo-boats are obsolete, and that probably no more will ever be built. But I believe that boats of the size of the destroyers will take their place in every navy, and that a competition as regards the numbers owned will begin."

A New Steering Device for Torpedoes.

One of the most important of the recent improvements in torpedoes, some mention of which has been made in another place, is a device for keeping the axis during the run always in the direction it had at the instant of launching. This has been accomplished both in Austria and Germany. The principle in both devices is that of a freely suspended gyroscope, which is used to bring the torpedo into its original direction through the agency of an air engine actuating a vertical rudder. The details, however, as indicated by the patent specifications, are quite different. From authentic accounts, the results of practice have been remarkable. The torpedo may be launched in any kind of weather, in any direction, from a torpedo-boat at its maximum speed by simply pointing the tube at the target. Although the torpedo is deflected as usual, the gyroscope at once brings it back to its original direction with only the error due to the short time it was off its course.

This principle is not new, as it has long been used in the Howell torpedo, but with the difference that in that torpedo the axis of the gyroscope is rigid. It, therefore, resists change of direction; but when the change has taken place, as on deflection when launched from the broadside at speed, it will no
the torpedo back.

With the new device, the practice at a fixed target a
be accurate even up to a range of 2000 y

working range will be easily extended beyond 1000 yards. It will always be difficult to make hits on a moving target, but it is a great gain to be able to eliminate the uncertainties of the initial deflection, hitherto the most serious drawback to accurate practice.

If it is found that the reports so far received continue to be borne out by results, it will be necessary to revise the tactics of ships as well as of boats. The value of the torpedo becomes greater than ever before, and the need of suitable torpedo-craft increases correspondingly.

Search-Lights in Torpedo Boats.

Some of the larger torpedo-boats and destroyers are equipped with search-lights. Their utility is open to doubt. The purpose for which they are carried is to light up torpedo-boats that may be discovered and make better marks of them for the guns. At high speeds or in a sea-way, it is doubtful if a search-light can be kept on as small an object as a torpedo-boat with sufficient steadiness to make her a good target. Steady platforms are adopted for the lights in some boats, but in the absence of experience with the fittings, I doubt if they entirely overcome the difficulty. The principle is again that of the gyroscope. The relative motion of the boat with reference to the plane of the gyroscope is utilized to actuate hydraulic motors in the proper sense to keep the platform steady.

The great drawback to the search-light is that there is no concealment for the boat carrying it as soon as it is turned on, and it gradually blinds the eyes of the lookouts. Boats which would certainly be seen were the lights not used might easily get by if they happened to avoid the beam. It would appear to be better to trust to good eyesight and good lookouts to pick up the quarry; then by superior speed to stick to him until he was put out of action, aiming in the meantime as well as previous training and the circumstances would permit.

Torpedo-Defense-Nets.

The day of the defense-net is apparently passed. The objections are that they are cumbersome, hard to get in and out, cannot be carried underway except on the broadside, and then only at a greatly reduced speed, are dangerous in action from

the liability to foul the propellers, could certainly not be used after an action, and might, on occasions when rigged out, prove a source of great embarrassment, due to the delay incident to getting them in.

Moreover, it was found that various devices could be fitted to the heads of torpedoes to cut through the nets. The weight was increased to the limit of practicability and all to no purpose. Ships now building are not being fitted with them. France, Russia and Austria, I believe, have definitely abandoned them, and opinion in other countries is decidedly adverse. The United States has never adopted them. This points to the necessity of considering other means for the defense of ships against torpedo-boats.

Attacks under the Search-Light.

I purpose under this heading to examine some of the conditions under which torpedo-boat attacks may take place. The kind indicated is most generally associated with the use of torpedo-boats. As will be seen later, however, the search-light, except to a very circumscribed extent, is not recommended as a form of defense.

I will take it as established that the attack must be at least partially a surprise. With the modern batteries of rapid-fire and automatic or semi-automatic torpedo-guns, it will be impossible for the torpedo-boat to exist for more than a very limited time if she is discovered before reaching torpedo range. What that time is may well be open to discussion. It will depend on the atmospheric conditions, the amount of light on the boat, the speed of the boat, the state of the sea, the number and character of the guns that can be brought to bear, and the expertness of the gunners. The boat then must try and get as near as possible before she is discovered at all, and the ship must find a way to discover and destroy the boat before the torpedoes can be launched.

With the present development of the automobile torpedo as a weapon of war, 500 yards is the admitted effective range. Reference has been made in another place to an apparatus for steering torpedoes that seems certainly destined to revolutionize ideas in this regard, but for the present it is not considered. Now as to the best means at the disposal of the offense to bring its

vessel could be one of the fast torpedo-boats now approaching completion. She would steam directly towards the ship at her highest speed under the conditions, the ship to turn her search-lights on the target and open fire the instant the torpedo-boat passed clear on the off side. The fire would be continued until the target was estimated to be at torpedo range, after which the hits would be counted. The line could then be shortened to reduce the interval of time under fire, and the experiment be repeated. Eventually there would be some very satisfactory data connecting speed, distance, time, number and character of guns, and number of hits.

From what I have seen of somewhat similar experiments in former years, except that the target was at rest, I am under the impression that in 25 seconds, the average time of reaching torpedo range from the probable distance of discovery, as determined by the Torpedo Station experiments, the torpedo-boat would not be found to be *hors de combat.* If the working range of the torpedo is materially increased by the new automatic steering device, all the arguments as above acquire added weight in proportion.

The rational defense of the ship, then, whether at anchor or underway, seems to be the scout, the torpedo-boat destroyer, the torpedo-boat, the vedette-launch, and the picket-boat. Our types of boats, then, would logically include all of the above, and, if possible, a boat adapted to evade them all. Here, perhaps, is the field for the submarine boat. This, however, opens a wide subject in itself. The essay is confined to surface boats.

Deductions.

The various types of vessels in which torpedoes are or have been the principal arm have now been passed in review, and some of the conditions governing their use have been examined. The present tendency of opinion, as has been shown, opposes the farther development of some of them. Taking up the types in order, the conclusions that appear to be justified as regards future permissible locations of torpedoes are somewhat as follows:

The unprotected torpedo is a surprise weapon. In battleships and large cruisers, surprise is not attempted; but protection for the torpedo may be found behind armor or in sub-

merged positions. The protection that is deemed necessary is not to prevent explosion of the war-head, which careful experiment has shown to be a very remote contingency, but is rather to prevent destruction of the tube and mount, or explosion of the air-flask, as the result of gun-fire, before the vessel reaches torpedo range.

The only remaining questions as regards these ships are as to the numbers of tubes and their location, whether above or below water. These questions will be decided more by structural considerations and future developments of the torpedo in accuracy and ease of handling as regards over- and under-water fire. There can be little doubt that the torpedo is a desirable weapon for such ships. It has been opposed frequently on the score of its lack of reliability and the supposed danger to its users and their friends, which was regarded as comparable in degree to its menace to the enemy. Improvements in the speed, range and accuracy of the torpedo, and in the safety of handling, must counteract such of this opposition as does not spring from lack of knowledge of the weapon.

In the case of torpedo-cruisers, the justification for the presence of torpedoes at all seems to have quite disappeared. These vessels are too big to effect a surprise in any conditions of weather, and they afford no protection to the torpedoes. On discovery by a larger vessel, their only safety lies in flight. Nor are they of any use against torpedo-boats. By reason of their size they are likely to be discovered themselves before they sight the boats, a circumstance which, taken in conjunction with their lack of speed, makes the capture or destruction of the boats quite improbable.

By omitting the torpedoes and heavy guns and carrying in their place a numerous and light gun armament, and making the speed as high as the changed armament will permit, there is secured a very effective scout and lookout vessel. This is decidedly the tendency of opinion abroad to-day, and the probabilities are that in the not distant future the torpedoes will have been wholly withdrawn from the type.

Passing on to the torpedo-gunboat, or torpedo-catcher, as they are still often called, much the same reasoning obtains. This class has had a varied career from vessels of the size of the Austrian Meteor of 350 tons to the English Dryad or Halcyon

of 1070. As we have seen, they are all unsatisfactory as designed. By removing their torpedoes and arming them entirely with light guns, they may be given a higher speed and thus be used as scouts and to assist the destroyers in keeping off the enemy's torpedo-boats. It is probable that the smaller ones will not be produced in the future. From the large cruiser to the present torpedo-boat destroyer, it is doubtful if there is any use for more than one type—a very fast gunboat of about 1000 tons, with a very numerous armament of medium and light rapid-fire guns and no torpedoes.

This brings us to the torpedo-boat destroyer and the torpedo-boat proper, which are now quite generally regarded as the only possible types of special torpedo craft. But when it comes to the essential features of these two types, opinions are very divergent, often, I think, due to varying conceptions of the duties of the boats in question.

This is instanced in the recent contracts for the 30-knot boats. The designs were here left to the builders. Nos. 9 and 10 as authorized are to be of 146 tons, while No. 11 is to be of 273 tons. These are odd results to follow from one clause of an appropriation act, designed to secure three essentially similar boats to carry the same armament and make the same speed. It is hard to see how the contractors for Nos. 9 and 10 are to fulfil the remaining requirements of equipment and coal supply, features in which the prototypes of these boats, as has been seen, are exceptionally deficient.

Nor would it seem to be possible that a satisfactory boat could be designed by the collective bureaus of the Navy Department that have to do with *matériel*, for the sole reason that the requirements of armament, equipment and machinery are all antagonistic to each other and to those of total displacement. If a board will first decide exactly to what use the boat is to be put, and what armament, speed, coal endurance and crew she will require for such use, then the displacement and horse-power will follow naturally. All the features will then be settled, and each bureau can have full swing in its own domain. If builders compete on their own designs, they also must use their skill within the limits of the settled requirements. If any other method is adopted in producing these boats, then when they are finished it will have to be determined what can be done with them.

I submit the following as some of the uses for which in our own case torpedo-boats will be required. I shall not say that these are the correct uses or all the uses; but the assumptions will at least lead to definite types of boats.

In the first place, boats, and a good many of them, will be needed for the defense of our seaports, and to operate for limited periods with the squadron near their own bases, where they can seek refuge in bad weather, leaving the Admiral entirely free of care in their regard, and can renew their supplies. These boats would be used also for massing at threatened points by means of our unrivaled inland-water communications.

Their purpose is to destroy the enemy's ships. This must be done by surprising him at night or in a fog. I leave out for a moment the case in which they attack from the lee of a battle-ship in action, or from a point near the scene of action, as opportunity offers. For a surprise attack at night, or in a fog, the boats should be as small as consistent with other considerations, otherwise the feature of invisibility is sacrificed. The weapon should be the equivalent of the long 18-inch Whitehead torpedo, with a speed of at least 28 knots at 800 yards and an explosive charge of 220 pounds of gun-cotton. The next smaller type sacrifices perhaps 50 per cent. of the destructive power and accuracy and reduces the value of the boat to a corresponding extent. Two at least of the torpedoes selected should be carried in central pivot training tubes on the deck of the boat, and one or more should be carried in reserve.

All torpedo-boats carry gun armaments with which to engage other boats, either for the purpose of proceeding on the intended mission or for turning back the enemy. A safe rule is to carry no less than the average armament of boats of the same size in any other service, and more if other considerations will permit. Some foreign boats carry four 3-pounders, and this is better than the average. It is a desirable armament for the purposes indicated. The automatic type of gun would be preferable should the system be found to be reliable in service. Guns of smaller caliber than 3-pounders are of little use, as it has been shown that they will not perforate the filled coal-bunkers of the ordinary torpedo-boat.

While on this subject of torpedo-boat engagements, it may be stated, as has been mentioned before, that ramming has often

been recommended as a quick method of settling matters if an opportunity is afforded. If a boat or vedette can be surprised and rammed before much alarm is given, it will be a decided gain. To do this a safe rule would be to strengthen the bow of each boat to permit her to ram her own equivalent or any smaller boat. Here at once we are met by the objection that fast, handy boats cannot be turned into rams without the sacrifice of speed, that they should be built for one purpose only, and if too much is attempted, all fails.

This is a very strong argument. The only point to consider in each case when it is a question of adding some new weight is this:—is speed everything; how much speed will be sacrificed by adding this weight, and will the advantage pay for the sacrifice? To strengthen the bow of a torpedo-boat to ram one of its like or any smaller boat will require, it is estimated, 5 to 10 pounds for every ton of displacement, or for a boat of 120 tons, 600 to 1200 pounds. This would be disposed in the form of internal strengthening plates, longitudinals, and transverse braces. The loss of speed in a boat of this size per ton of added weight is estimated to be one-tenth of a knot. The weight proposed would therefore diminish the speed of the boat by the twentieth part of a knot.

While it is not claimed that the bow of a torpedo-boat thus strengthened would be absolutely uninjured by ramming, it is believed that the object would be attained without material damage. Incidentally, the boat could cut through several inches of ice without the least injury, a feature which in winter might prove of the greatest value in some of our northern ports and in the canals.

The ram form of bow is not advocated. The straight stem offers better sea-qualities and it can be made to cut as effectively as may be required. The writer saw the Richard Peck, a Long Island Sound steamer, with a straight stem, cut a tug in two halves without any apparent injury to herself. During the French manœuvres last summer, the Audacieux, a sister of the Agile, a boat the size of our Cushing, collided accidentally with the Chevalier, striking her on the side. The Audacieux's bow was wrecked, and the collision bulkhead did not stop the entrance of the water, resulting in the loss of the boat. The Chevalier had her side protected by an angle belt of steel with a wood backing, and though injured, was kept afloat. This

points to the need of more strength in the bow, whatever conclusion may be drawn as to that required on the side.

The elements of size, speed, coal endurance, and sea-keeping qualities are to a great extent interdependent. We have seen that the size cannot with advantage be great, or the boat would be too readily discovered on a surprise attack. This in itself limits the other qualities. Now the coal endurance and sea-qualities need not be greatly developed for the purposes set forth, especially the latter. When the weather is too bad for a boat of say 120 tons to remain at sea, it is too bad to launch torpedoes, and she may as well seek shelter.

It is somewhat different with the coal supply, as it might be necessary to return to port to coal at a very critical moment. Therefore the coal endurance, while not necessarily as great as for a sea-going boat, should not be unduly sacrificed. A week's continuous steaming at squadron speed, equivalent to 18 hours at full speed, is about the lowest point at which the endurance can well be placed. Of the boats quoted in the tables, the average endurance at 2 pounds per indicated horse-power per hour, is between 18 and 19 hours. This endurance can readily be obtained in a boat of 120 tons, provided excessive speed is not attempted, and still an ample margin be left for the guns and torpedoes as recommended.

In this connection may be mentioned the great confusion associated with the term "normal displacement." As understood by builders, it means enough coal for the trial and as many other weights omitted as the government will permit. A rational definition of normal displacement is the displacement with all the ordnance and equipment weights aboard, the crew and their effects, and half the coal, provisions and stores that would be carried when fully loaded for sea. If it was understood that trials were to be conducted with such weights aboard as would cause the mean trial displacement to be the normal displacement as above defined, the whole question would be manifestly simplified.

As regards speed, there will be many divergent opinions. On general principles, speed is good, and it should be as high as possible. When it comes to sacrificing torpedoes, or guns, or the power to ram, or coal endurance, or involves a much increased size, then a very careful consideration should be given the relative values of the different qualities. Now what are the

objects of speed? The first answer is, to get up to the enemy as quickly as possible after discovery, in order that he may not destroy you by gun-fire, and to get away from him quickly for the same reason; secondly, to be able to strike unexpectedly from a distance in a brief time; thirdly, to avoid the enemy's destroyers.

In the first case suppose that 22½ and 30 knots are two speeds to be compared. 1500 yards is a long distance at which to discover a torpedo-boat if the night is at all suited for an attack. At 500 yards the boat can discharge her torpedoes. The time in passing from 1500 to 500 yards is, for the lower speed, 1 minute and 20 seconds, and for the higher speed 1 minute. Other things being equal, the 30-knot boat will be larger and can be seen farther, and will afford a better target to the guns, which will cause even this difference to vanish. If coal endurance has been sacrificed to accomplish speed, the sacrifice will be immense, and for how small an advantage! Moreover, torpedoes, as at present fitted, cannot be launched with accuracy at either of the above speeds. The boats will have to be slowed materially on reaching the range. Then, too, prior to discovery, it will not be advisable to steam at more than 12 knots, to avoid water disturbance and flame at the funnels. When the time for working up to full speed after discovery, and then reducing to allow of accurate torpedo discharge is considered, there will be a very inappreciable difference in the two boats. In fact the high speed boat will not have time to work up to full speed, and the slower boat may arrive as soon. This argument may be modified to a certain extent by the new device that will permit torpedoes to be launched with accuracy at any speed. But when we consider that a boat discovered at 1500 yards is in all probability a boat lost, if she attempts the attack, and that success depends on getting pretty close to torpedo range without discovery at all, the argument in favor of the 30-knotter as opposed to the boat of 22½ knots is reduced to practically nothing. All the above to be understood to apply to the case of the boat operating from a shore base, or with the squadron on its own coast for limited periods.

As to being able to strike quickly from a distance, of course the higher the speed, the better; but the difference between 30 knots and 22½ does not warrant the very considerable sacrifice of other qualities for this purpose alone.

Now as to avoiding the destroyers in the enemy's fleet. Here is the only approach to an argument for the higher speed. If you can arrange that a torpedo-boat of average size with high speed and no coal endurance shall start from port and find the enemy without delay, she may with her speed get past the enemy's destroyers should they sight her, provided the weather is perfectly calm. With any sea on, the larger boats will soon run her down. Then she must not lose any time in finding the enemy, or her coal will be gone. It must not be lost sight of that this speed of 30 knots or more in a comparatively small boat is attained by sacrificing either coal, stores, or armament. No, it looks as if the way to get past the enemy's destroyers was to have a larger number of ordinary first-class boats, select a dark night and make a concerted attack. Some of the boats will be lost, but some will probably get in; and a ship or two of the enemy will make up for losses.

As to the best type of boat, therefore, for the purpose designated, and in view of the reasoning as above stated, there is apparently little question that a boat of 150 feet and 120 tons would fulfil all the requirements; in other words, a boat of the size of the Ericsson. Her contract speed is 24 knots, which is high enough; but which could be exceeded now on the same weights. She carries 40 tons of coal, sufficient for a day at full speed and a week or more at 10 knots. The armament could be improved by giving her four 3-pounders instead of three 1-pounders, and two 18-inch torpedo-tubes for long torpedoes instead of the present three tubes for short torpedoes; the tubes to be mounted on the central line with train on either beam. The number of torpedoes could remain four, as at present, or two for each tube. The difference in weight, allowing 200 rounds of ammunition for each gun, would be 5.2 tons, of which less than half a ton is due to the change of torpedoes and tubes. This weight could be taken from the coal capacity, reducing the endurance by 3½ hours; as could also 1200 pounds to fit her bow for ramming, involving a further reduction of the endurance by 20 minutes; but leaving it still over 20 hours.*

* The weights on which this calculation is based are as follows :—

Short 18-inch, torpedo	850 pounds,	tube	1,100 pounds,	mount	300 pounds.
Long 18-inch,	"	1,100	"	"	1,500	"	"	600	"
1-pounder, gun and mount	455 pounds,	200 rounds amm. boxed,	390	"
3-	"	"	"	1,610	"	"	"	"	"	1,675	"

If these boats were intended in special cases never to leave the neighborhood of their own bases, a better arrangement of the torpedoes would be to omit one torpedo and install a third tube, thus carrying three torpedoes, one in each tube. The boats would replenish their torpedoes at their bases, as required. This would involve an additional weight of 1000 pounds, which would not be prohibitive.

The next purpose to consider for which boats may be required is to accompany the fleet for indefinite periods. They may be intended to destroy the enemy's torpedo-boats or to act against his ships. For the last-named purpose the type just described would be most appropriate were it not that the endurance and sea-keeping qualities are both deficient. Near their own bases, as before shown, they may be of the greatest value. But to ensure endurance and sea qualities it is necessary to pass at once to double the displacement at least. Invisibility has to be sacrificed to ensure this ability to keep the sea with the fleet in all weathers. But granting a certain sacrifice of invisibility, it is not desirable to dispense with that quality altogether. A displacement of 250 to 300 tons can be made to produce a seaworthy boat, though perhaps not always a comfortable one. Then it is of a size that does not entirely preclude the possibility of a surprise attack on a suitable night. With this displacement it is possible to attain a satisfactory coal endurance, and in addition to increase the speed by several knots.

According to Froude's investigations, as instanced by Mr. Thornycroft in a lecture before the Royal United Service Institution in May, 1895, it is at this point that speed is more economically attained than at other displacements short of several thousand tons. This reason, and the objection to a further sacrifice of invisibility, and the desirableness of not increasing the draught beyond the requirements of shoal-water navigation, all tend to prevent a further increase of displacement. Moreover, with us, this limit is imperatively set by the dimensions of canal locks.

The argument against intermediate sizes is that for use from a fixed base they are larger than necessary, as already shown. They can be given a higher speed at the sacrifice of invisibility, but this is not desirable. For continuous use with the fleet they are not large enough to offer that guaranty of comfort and seaworthiness

in all weathers deemed to be essential to the effectiveness of the crew.

With regard to the armament of these boats, the conditions already laid down make it possible to combine two objects. It was stated that the boats with the fleet were intended for use against ships or torpedo-boats. Now in the type arrived at, the considerations contemplated the first use only. But after giving the boats three torpedo-tubes, which is all they require (the recent English destroyers have two), there is still a margin of weight that can be applied to a very effective gun armament. Moreover, their high speed enables them easily to overhaul boats of the smaller type. Hence this large type is logically capable of both uses, or of any use to which boats with the squadron may be put; either to destroy the enemy's ships when opportunity offers, or to defend the squadron against the enemy's torpedo-boats.

It is curious to notice that the actual differentiation of this type, destroyers as they are called, was quite different. They were built originally to catch torpedo-boats. They were to be large enough and have speed enough to overtake torpedo-boats in rough or smooth water, and were to be able to follow them into shoal water. They were to carry a powerful gun armament, sufficient to destroy any torpedo-boat. At first even it was not contemplated to give them torpedoes. But as they would then have been harmless against large ships, and would have had no weapon with which to defend themselves, it was decided to arm them with a few torpedoes also. It has been shown that they are able to carry both guns and torpedoes. After several years' experience with the type, it appears that they are just what is required for general use with the fleet. Thus, more or less by accident, a type has been developed which a logical consideration of the requirements indicates to be the only one admissible.

The armament of the latest English destroyers is two torpedo-tubes for the long 18-inch Whitehead, one 12-pounder rapid-fire gun, and five 6-pounders. Spare torpedoes are also carried. I believe these boats would suit our purposes better were another tube added, and the gun armament changed to eight 3-pounders. The boat would then go into action with three torpedoes ready for launching, and with a light and numerous homogeneous battery of rapid-firers. The automatic type of gun is to be pre-

ferred. The weight saved by this change I estimate to be two tons, a part of which could go to supplying enough torpedoes to make two for each tube, and the rest to extra ammunition for the 3-pounders.

As to other types of torpedo-boats than those heretofore considered, it has been shown that a farther increase of size is not permissible. Can a smaller type than either of the above ever be of use? It may be answered that with all the conditions favorable, smaller boats may sometimes make successes. But in view of the great limitations to their use, it is not the part of policy to include them as standards of type. There may be limiting considerations of draught of water and length of canal locks that will determine a type of boat, in which case the limitations have to be observed. Ordinarily the power of offense, sea qualities, coal endurance and speed would be reduced to a point that would result in an unsatisfactory boat.

Much has been written in regard to the place of the torpedo-boat in a fleet action. It has been assumed in the present essay that the squadron on its own coast would be attended by both torpedo-boats and destroyers. In case it is found desirable to employ torpedo-boats in an action at sea, are the two types recommended suitable for such use, or should there be still a third type for this purpose alone? The only methods that have been much advocated are for the boats to keep in the line, each one on the off side of a battleship; or for them to haul out at the beginning of the action and watch a chance to fall on a partially disabled or otherwise occupied enemy.

In the first case the boats should be small and handy, ready to dart out at any moment to take advantage of smoke, should there be any, or such cover as their own or disabled ships of the enemy might offer. In the second case speed would be the great desideratum. Two or three boats might strike suddenly at an enemy that had been compelled to leave the line, either temporarily or permanently. Here, also, boats would be required to act on the defensive and protect disabled ships of their own line from the attacks of the enemy's boats.

Although it has sometimes been advocated that torpedo-boats should make concerted attacks on the enemy's line by day, prior to beginning an action, I cannot conceive of such an attack by a sane commander, except in case of fog or mist, which would liken the conditions to those of night-time.

For any of the above uses, torpedo-boats and destroyers of the types already recommended would seem to be the choice in preference to other possible types. In fact the determining requirements of armament, invisibility, sea qualities, speed, and endurance are precisely the same, and would therefore in natural course produce the same results.

As to second-class torpedo-boats for carrying on shipboard, the weight of opinion is not in favor of them. There might be circumstances in which they could be lowered and sent against the ships of an enemy at anchor and near-by, or in fine weather when about to pass a known point. But it is not to be supposed that the enemy will be unprovided with torpedo-boats or destroyers, which would make quick work of the second-class boats. Again, should the weather come on bad while the boats were away, they would be a great source of uneasiness to the squadron. In a fleet action they would be shot to pieces if left in their cradles, and if the weather was bad it would be equally unsafe to lower them. Then, too, if the fleet is properly provided with torpedo-boat destroyers when cruising at a distance, and with first-class boats when near home ports, the second-class boats will not be required.

There seems to be a need, however, of a sufficiently large and fast ship's boat to act as a vedette. The larger ships could carry one or two of them. With the squadron at anchor in striking distance of the enemy's torpedo-boats, these vedette-launches would form a line of defense inside the torpedo-boats and destroyers. They need not carry torpedoes at all for this purpose, but would be armed with a couple of rapid-fire guns and would be well provided with signal rockets. Torpedoes in fact would be a disadvantage, as they would interfere with the gun armament. The use of torpedoes against torpedo-boats is not feasible, on account of the difficulty of hitting a fast-moving target. Also torpedoes set for ships would pass under them.

For purposes such as the above, a fast wooden launch of 50 to 60 feet, capable of steaming 17 knots and carrying two light guns, would meet all the requirements. Wood seems to withstand rough usage better than thin steel. The boats have more elasticity and can be handled with fewer precautions. They are also more easily repaired when damaged. A boat like this would be useful in many other ways aboard ship, especially when the anchorage was distant from the landing. They would have to

take their chances in an action with the other ships' boats. All would probably be lowered and left to their fate, or to be picked up by the victors.

The English fit these boats with side dropping frames for torpedoes. The frames are removable and are not ordinarily carried. This is perhaps the only feasible way of using torpedoes from ships' boats in the few cases in which they would be required. The short 18-inch torpedo, or baby Whitehead, as it was called, was originally used in these boats; but lately the long 14-inch has been substituted on account of its greater accuracy. The weight of gun-cotton in the two torpedoes is practically the same.

The internal arrangements of the boats reviewed were not described. There is a feature, however, that warrants mention, the disposition of engines and boilers as regards safety against disablement. Twin screws are desirable as a matter of course, though a number of foreign boats do not have them. They make the boat handier and lessen the chance of a complete breakdown. By disposing the engines one in advance of the other in separate water-tight compartments, and protecting them by coal-bunkers at the sides, the chances of complete disablement are much reduced. In some foreign boats the engines are side by side with no coal outboard of them, a practice certainly not to be desired. For similar reasons the boilers should be in separate compartments.

Some foreign nations, notably the Italians, have experimented for a long time with liquid fuel. There is perhaps no one feature that can be made of more value to torpedo-boats. The advantages to be gained are greater endurance for the same weight, greater facility for renewing fuel, absence of smoke, more regular steam, and less attendance. This last advantage involves a saving in weight and space that may be applied to an increase of either speed, endurance or armament on the same displacement. Added to these advantages, that we have in this country a practically unlimited supply of petroleum oils, which can be stored for use at the torpedo bases, and carried in the larger ships for the use of the torpedo-boats, that is until such time as the ships themselves are fitted to burn it, when it can be drawn from their tanks, and the argument for an early resort to liquid fuel seems unanswerable.

Since the above was written it is noted that the Secretary of the Navy in his annual report states that in consequence of the

satisfactory results of the recent trials of liquid fuel in the Maine's torpedo-launch, farther experiments are to be made in a tug now building at Norfolk and in one of the smaller boats contracted for by the Herreshoffs.

Leaving the question of torpedo-boats, there is one other type that may be briefly referred to again—the torpedo-ram. A vessel a little larger and a little faster than the Katahdin, and fitted with several submerged broadside tubes, something after the fashion of the Polyphemus, might prove a valuable adjunct to the fleet. The turtle-back upper works could be made impregnable to the projectiles of rapid-fire guns. By watching her chances and rushing in at an opportune moment, using either torpedoes or ram as circumstances indicated, she might very well score an important success.

Recapitulation.

The conclusions here arrived at may be summarized as follows:

Torpedoes are not permissible afloat except in large ships, submerged or behind armor, and in special torpedo-craft of less than 300 tons displacement.

There are only two types of torpedo-boats that seem to meet the requirements of torpedo service with the squadron at sea; and, from fixed bases, for the defense of the seaports and harbors of the coast.

The first is a high-sea torpedo-boat of 250 to 300 tons, generally similar to the present English destroyers, to mount three long 18-inch torpedo-tubes on the central fore-and-aft line, with a spare torpedo for each tube, and a homogeneous battery of eight 3-pounders, preferably of the automatic type; this boat to keep the sea with the fleet at all times and to be used either as torpedo-boat or destroyer. The speed and coal endurance are to be as high as the displacement and armament of the boat will permit.

The second type is a first-class torpedo-boat of 150 feet and 120 tons, carrying two or three torpedo-tubes according to circumstances, as previously indicated, all for the long 18-inch torpedo, and mounted on the central fore-and-aft line. In case two tubes are carried there will be a spare torpedo for each tube; if three tubes, then one torpedo only for each tube. The gun armament to be four 3-pounders. A speed of 24 knots will be

ample for this boat, and will permit of a coal endurance of at least 18 hours at full speed.

Both types should have twin screws and the engines should be in separate compartments longitudinally to minimize the risk of complete disablement, and to permit coal protection throughout the machinery space.

The bows of the boats should have sufficient strength to cut into the sides of any similar boat, or to permit running over a vedette-launch; which incidentally would enable them to cut through several inches of ice without injury, a feature of some value for inland-water navigation in the winter.

For each of the battleships and armored cruisers, it would be desirable to provide one or two wooden vedette-launches of 50 to 60 feet in length to steam 17 knots, to be armed ordinarily with two light guns, or, as an alternate on special occasions, with a smaller type of torpedo carried in removable frames.

The proportion of the two types of torpedo-boats could very well be one of the larger to two of the smaller; and that number would be a suitable proportion to each battleship and armored cruiser. These boats could be authorized at the rate of a dozen a year until the full number was reached, and thereafter it would be the part of policy to provide for a destroyer and two torpedo-boats whenever a large ship was laid down.

May it be permitted at the close of this paper to make a sentimental plea for naming instead of numbering torpedo-boats? The general practice abroad is to number the smaller boats, though this is not invariable, and usually to name the larger ones. Boats of the size of those here recommended are almost always named. I cannot think of any possible reason for not naming our boats, unless it is that if we have very many, the names may give out. That time has certainly not yet arrived. One disadvantage of numbers is that they are easily confused in orders and reports. For that reason cable codes make use of names to represent numbers.

But after all, the real reason for naming the boats is a sentimental one. If officers and men are willing to risk their lives in a torpedo attack, and honestly prefer to serve in a boat with a significant name instead of an insignificant number, their wishes ought to be considered.

Torpedo-Boats.

Name.	Date.	Builder.	Nation.	Length.	Tons.	I. H. P.	Speed.	Coal.	Lbs. per I. H. P.	Guns.	Tubes.
Miranda	71	Thornycroft	Yacht	50	...	....	16.2	....	..	.....	.....
Rasp	73	"	Norway	57	16	90	17.2	2	50	.....	.....
1 Boat	74	Yarrow	Argentine	55	...	65	12.5	....	..	.....	.....
Glimt	75	Thornycroft	Sweden	58	...	60	18	1.5	56	1 M.	1
Lightning	76	Herreshoff	U. S.	58	3	....	17.6	....	..	....	.....
Gitana	76	Thornycroft	Yacht	86	29	450	20.7	....	..	.....	.....
Lightning	77	"	England	84	27	460	19.4	....	..	.....	1
Nos. 17, 18	77	Yarrow	"	86	33	450	21	7	35	.....	2
No. 14	78	"	"	87	33	550	21.9	7	29	.....	2
Several	78	Various	France	108	45	400	19	10	56	2 1-Pd.	2
1 Boat	79	Herreshoff	England	60	8	...	16	...	..	.....	.....
4 Boats	79	Yarrow	Japan	100	40	620	20	3	11	.....	.....
No. 10	80	Thornycroft	England	90	28	450	22	....	..	.....	1
Batoum	80	Yarrow	Russia	100	40	500	22	10	45	2 R. C.	2
Svaerdfisken	81	Thornycroft	Denmark	110	50	600	20	10	37	1 "	2
1 Boat	82	Yarrow	Italy	100	...	500	22.5	10	45	.....	2
2 Boats	82	Schichau	"	100	40	620	22	10	36	1 R. C.	2
Sookhum	83	Thornycroft	Russia	113	64	700	19.5	10	32	2 "	2
Poti	83	Normand	"	125	72	570	18.5	11	43	2 "	2
63 Boats	83–90	Schichau	Germany	121–128	85–88	1000	19–22	....	..	2 R. C.	2
Swift	85	White	England	150	125	1300	20.8	35	60	6 3-Pd.	2
Falke	85	Yarrow	Austria	135	95	1250	22.4	28	50	2 M.	2
6 Boats	85	Stettin	Greece	128	85	1050	19	20	43	4 R. C.	.....
57 Boats	85–6	T., W., Y.	England	113–128	60–75	600–1000	18–22	10–20	37–45	2 3-Pd.	1–5
Balny	86	Normand	France	135	70	700	20	12	38	2 R. C.	2
Kotaka	86	Yarrow	Japan	170	190	1400	19	50	80	4 M.	6
Wiborg	86	Thomson	Russia	142	142	1400	20.6	45	72	2 R. C.	3
Revel	86	Normand	"	152	96	800	22	30	84	2 R. F.	2
1 Boat	86	Schichau	China	144	...	1597	24.2	....	..	4 M.	2
No. 80	87	Yarrow	England	135	105	1540	23	30	44	4 3-Pd.	5
2 Boats	87	Italy	Italy	135	110	1600	24	30	42	1 1-Pd. 1 R. C.	5
2 Boats	87	Yarrow	"	140	100	1600	25.1	30	42	2 3-Pd. 1 R. C.	5
Ariete	87	Thornycroft	Spain	148	97	1600	26.1	25	35	4 3-Pd.	2
Coureur	87	"	France	148	120	1550	23.5	22	32	4 M.	2
2 Boats	88	"	Denmark	138	95	1200	22.5	15	28	2 1-Pd.	4
Alarme	88	St. Nazaire	France	151	148	1400	20.5	40	64	2 3-Pd.	4
Aquila	88	Schichau	Italy	152	130	2200	26.6	40	41	2 3-Pd. 2 1-Pd. 1 R. C.	3
Agile	89	La Seyne	France	139	103	1100	20.4	14	29	3 3-Pd.	2
14 Boats	89	Creusot	Japan	115	56	525	20	....	..	2 1-Pd.	2
5 Boats	89–90	Gaarden	Turkey	127	85	1300	22	20	34	2 R. C.	2
Murature	90	Thornycroft	Argentine	150	110	1500	24.5	22	33	3 3-Pd.	3
Adler	90	Schichau	Russia	152	130	2200	27.4	....	..	.....	2
Cushing	90	Herreshoff	U. S.	138	106	1720	24	39	51	3 1-Pd.	3 18" S.
2 Boats	91	Schichau	Japan	125	90	1300	23	24	41	.....	3
3 Boats	91	Thornycroft	Brazil	150	150	1800	25.4	22	27	2 1-Pd.	4 14"
Dragon	92	Normand	France	138	119	1400	25	16	26	3 3-Pd.	2
Corsaire	92	St. Denis	"	160	150	2500	25.5	15	13	4 1-Pd.	2 18" L.
Ericsson	92	Dubuque	U. S.	150	120	1800	24	40	50	4 1-Pd.	3 18" S.
Pedro Ivo	92-3	Schichau	Brazil	152	130	2200	26	30	31	2 1-Pd.	3
Lansquenet	93	Nantes	France	165	138	2800	24.5	18	14	2 1-Pd.	2
Mousquetaire	93	Graville	"	154	125	2100	24.8	18	19	2 1-Pd.	2 18" L.
Chevalier	93	Normand	"	144	118	2700	27.2	17	14	2 1-Pd.	2 18" L.

TORPEDO-BOATS.—*Continued.*

Name.	Date.	Builder.	Nation.	Length.	Tons.	I. H. P.	Speed.	Coal.	Lbs. per I. H. P.	Guns.	Tubes.
10 Boats	93-5	Y., T., W., L.	England	140 / 142	100 / 130	1430 / 2690	21 / 24	18 / 26	28 / 22	3 3-Pd.	3
5 Boats	93-4	Schichau	Germany	144	125	2500	25	....	..	2 R. C.	3
19 Boats	93-5	.....	Italy	131	85	1000	22	7	16	2 1-Pd.	2
4 Boats	94	Schichau	China	...	120	....	24.5	....	..	2 R. F.	2
Aquilon	95	Normand	France	138	120	2000	26.2	17	19	2 3-Pd.	2
8 Boats	95	Schichau	Germany	144	140	1500	22	....	..	2 R. C.	3
Forban	95	Normand	France	144	130	3250	31.2	15	10	2 1-Pd.	2 / 14″
Viper	95	Yarrow	Austria	148	120	2000	26.6	30	34	.....	2
6 Boats	95-6	....	Russia	138	118	...	25	...	..	.....	2
5 Boats	96	.. ..	France	121	80	1500	24	14	21	2 1-Pd.	2
Mangini	96	Nantes	"	147	129	2100	25	17	18	2 3-Pd.	2
1 Boat	96	.....	China	137	120	1250	20	....	..	2 3-Pd.	2
4 Boats	96	.....	Spain	147	97	1600	25	25	35	.....	2
Natter	96	Schichau	Austria	151	150	2268	26.5	30	30	2 3-Pd.	3
Cyclone	Bldg.	Normand	France	...	148	3500	31	....	..	.....	.....
Nos. 3, 4, 5	"	Columbian / Iron Works	U. S.	160	142	2000	24.5	50	56	3 1-Pd.	3 / 18″ S.
Nos. 6, 7	"	Herreshoff	"	175	180	4000	27.5	68	38	4 1-Pd.	3 / 18″ S.
No. 8	"	Moran Bros.	"	170	182	3200	26	60	42	4 1-Pd.	3 / 18″ S.
Nos. 9, 10	"	Bath / Iron Works	"	147	146	4200	30	32	17	4 6-Pd.	3 / 18″ L.
Nos. 12, 13	"	Wolff & / Zwicker	"	146	117	1750	22.5	25	32	3 1-Pd.	3 / 18″ L.
No. 14	"	Herreshoff	"	140	103	1750	22	28	36	3 1-Pd.	3 / 18″ L.
Nos. 15, 16	"	"	"	100	47	850	20	....	..	1 1-Pd.	2 / 18″ S.
No. 17	"	Chas. Hillman	"	102	65	850	20	16	42	1 1-Pd.	2 / 18″ S.
No. 18	"	Columbian / Iron Works	"	102	65	850	20	16	42	1 1-Pd.	2 / 18″ S.

MISCELLANEOUS VESSELS.

Name.	Date.	Where Built.	Nation.	Length.	Tons.	I. H. P.	Speed.	Guns.	Tubes.
Vesuvius	74	.....	England	90	245	350	9.7	None.	4
Pietro Micca	76	....	Italy	203	550	1400	14	2 M.	2
Drott	77	Stockholm	Sweden	175	630	900	13	4 R. F.	3
Hecla	78	Belfast	England	392	6400	2400	11.7	6 40 to 64 Pds. / 14 Machine. / 5 Torp. Boats.	5
Japon	..	.....	France	315	3400	1500	11.2	2 Small.	..
Tordenskjold	80	Copenhagen	Denmark	222	2400	2600	14	1 30 cm, 2 15 cm, / 2 12 cm, 8 M.	4
Polyphemus	81	Chatham	England	240	2640	5500	18	6 6-Pd., 2 M.	5
Division Boats	87 / 95	Elbing	Germany	185 / 213	250 / 380	1800 / 4000	21 / 26	6 R. F. & R. C.	3
Vulcan	89	Portsmouth	England	350	6620	12000	20	37 R. F. & M. / 6 Torp. Boats.	6
Pelikan	91	Elbing	Austria	279	2440	4700	18.3	2 6-in., 8 R. F., / 36 Torpedoes.	..
Foudre	95	Bordeaux	France	371	6100	11400	19	16 R. F. / 10 Torp. Boats.	4

DESPATCH-VESSELS AND TORPEDO-CRUISERS.

Name.	Date.	Where Built.	Nation.	Length.	Tons.	I. H. P.	Speed.	Guns.	Tubes.
Zieten	76	Blackwall	Germany	197	975	2350	16	10 M.	2
Staffeta	76	Sampierdarena	Italy	253	1388	1900	14	4 12 cm, 11 Small.	1
Blitz	82	Kiel	Germany	246	1382	2800	16.3	1 4¾", 4 3¾, 4 M.	1
Alacrity	85	Jarrow	England	250	1700	3000	17.8	10 6-Pd., 2 M.	..
Curlew	85	Devonport	"	195	950	1200	14.5	1 6", 3 5", 7 M.	3
Leopard	85	Elswick	Austria	224	1530	6000	18.5	2 12 cm, 10 R. F. & M.	4
Scout	85	Clydebank	England	220	1580	3200	16.7	4 5", 11 R. F. & M.	(11) 7
Condor	85	Rochefort	France	217	1240	3600	17.7	5 10 cm, 7 R. F. & M.	5
Infanta Isabella	85	Cadiz	Spain	210	1152	1500	14	4 4.7", 4 6-Pd., 1 M.	2
Greif	86	Gaarden	Germany	318	2000	5400	23	3 3.9", 10 R. C. & M.	..
Milan	86	St. Nazaire	France	303	1546	4132	18.4	5 3.9", 8 1 Pd.	2
Archer	86	Clydebank	England	225	1770	3500	16.5	6 6", 11 R. F. & M.	8
Coreetz	86	Stockholm	Russia	206	1213	1500	13.5	2 8", 1 6", 8 R. F. & R. C.	2
Dogali	86	Elswick	Italy	260	2000	7600	19.7	6 6", 15 R. F.	4
Tiger	87	Triest	Austria	231	1641	6000	19	4 4.7", 10 R. F.	4
Archimede	87	Venice	Italy	230	784	1700	16	4 4.7", 4 R. F. & R. C.	2
Wacht	87	Bremen	Germany	279	1240	4000	20	4 3.4", 2 M.	3
Isla de Cuba	87	Elswick	Spain	185	1040	2627	16	6 4.7", 8 R. F. & M.	3
Yorktown	88	Philadelphia	U. S.	230	1700	3660	17.2	6 6", 9 R. F., R. C. & M.	(8)
Cosmao	89	Bordeaux	France	312	1877	6300	20.5	4 5.5", 7 3-Pd.	5
Barracouta	89	Sheerness	England	220	1580	3000	16.5	6 4.7", 6 R. F. & M.	2
Barham	89	Portsmouth	"	280	1830	4700	18.6	6 4.7", 6 R. F. & M.	2
Falke	91	Kiel	Germany	256	1580	2800	15.5	8 3.9", 4 1-Pd.	1
Wattignies	91	Rochefort	France	233	1310	4200	18.6	5 3.9", 13 R. F. & R. C.	4
Kondor	92*	Hamburg	Germany	246	1640	2700	16.5	8 3.9", 5 R. C.	2
Coatit	Bldg.	....	Italy	...	1313	....	23	....	..

TORPEDO-GUNBOATS.

Name.	Date.	Where Built.	Nation.	Length.	Tons.	I. H. P.	Speed.	Guns.	Tubes.
Spalato	79	Triest	Austria	180	840	1000	14	4 9 cm, 8 Small.	2
Sebenico	82	Pola	"	187	840	1200	14	Ditto.	1
Lussin	83	Triest	"	200	840	1000	14	2 15 cm, 8 Small.	2
Bombe	85	Havre	France	197	395	2000	18	7 R. F. & R. C.	2
Rattlesnake	86	Birkenhead	England	200	550	2800	19.5	1 4." 6 3-Pd.	4
Folgore	86	Castellamare	Italy	186	377	2000	20	7 R. F. & M.	4
Tripoli	86	"	"	230	845	3600	20	1 12 cm, 7 R. F.	5
Destructor	86	Clydebank	Spain	193	458	3800	20.2	1 9 cm, 6 R. F. & M.	5
Ilyen	86	....	Russia	230	600	3550	20.1	13 R. F. & R. C.	7
Meteor	87	Elbing	Austria	187	350	3300	23	9 3-Pd.	4
Sharpshooter	88	Devonport	England	230	735	3500	19	2 4.7," 4 3-Pd.	5
Planet	89	Jarrow	Austria	210	500	3500	19.6	10 R. F.	3
Temerario	89	....	Spain	190	570	2600	20	2 12 cm, 5 R. F. & M.	2
Espora	90	Birkenhead	Argentine	210	615	3500	20	7 R. F. & M.	5
Condell	90	"	Chile	230	750	4350	20.3	{ 3 14-Pd. / 4 3-Pd., 2 M. }	5
Meteor	90	Gaarden	Germany	262	946	4500	21	4 R. F.	3
Kazarsky	90	Elbing	Russia	190	400	3500	22	9 R. F.	2
Léger	91	Lorient	France	197	450	2230	18.8	1 10 cm, 7 R. F.	3
Filipinas	92	Cadiz	Spain	233	747	4500	20	2 12 cm, 8 R. F. & M.	4
Alarm	92	Sheerness	England	230	810	3500	19.2	2 4.7," 4 3-Pd.	3
D'Iberville	92	St. Nazaire	France	262	925	506	21.6	1 10 cm, 7 Small.	6
Gustavo Sampaio	93	Elswick	Brazil	196	500	2300	18	2 20-Pd., 4 3-Pd.	3
Satellit	93	Elbing	Austria	220	500	4900	22.5	9 3-Pd.	..
Speedy	93	Chiswick	England	230	810	4500	20	2 4.7," 4 3-Pd.	3
Dryad	93	Chatham	"	250	1070	3700	18.5	2 4.7," 4 6-Pd.	5
Patria	93	Birkenhead	Argentine	250	1183	5000	20.7	{ 2 4.7," 4 8 Pd. / 2 3-Pd., 2 M. }	5
Cassini	94	Havre	France	262	958	5000	21	13 R. F.	3
Caprera	94	Leghorn	Italy	230	853	4250	19.8	{ 1 12 cm. / 4 6-Pd., 2 1-Pd. }	4
Magnet	96	Elbing	Austria	221	473	3700	26	6 3-Pd.	3
Dunois	Bldg.	Cherbourg	France	256	896	6400	23	12 R. F.	..
Molinas	"	....	Chile	295	1200	.....	...	14 R. F., 2 M.	4

TORPEDO-BOAT DESTROYERS.

Name.	Date.	Builder.	Nation.	Length.	Tons.	I. H. P.	Speed.	Coal.	Lbs. per I. H. P.	Guns.	Tubes.
Havock	93	Yarrow	England	180	220	3500	26.8	57	36	1 12-Pd. 3 6-Pd.	3
Hornet	93	"	"	180	220	4600	27.3	57	28	Ditto	3
Daring	93	Thornycroft	"	185	220	4842	28.6	50	23	2 12-Pd. 3 6-Pd.	3
29 Boats	93-5	Various	"	190 200	220 280	3200 4800	27 29	60 70	42 33	1 12-Pd. 5 6-Pd.	3 2
7 Boats	94-5	Laird	"	210	265 300	4400 6000	27 30	..	..	Ditto	2
Sokol	95	Yarrow	Russia	190	240	4490	30.3	60	30	1 12-Pd. 3 6-Pd.	2
Desperate	96	Thornycroft	England	210	272	5600	30.5	..	..	1 12-Pd. 5 6-Pd.	2
4 Boats	96	Laird	Chile	210	300	6000	30	..	..	Ditto	2
Sante Fé	96	Yarrow	Argentine	190	250	4000	26.5	80	45	1 14-Pd. 3 6-Pd. 2 M.	3
Furor	96	Thomson	Spain	220	380	6200	28.2	..	..	2 14-Pd. 2 6-Pd. 2 M.	2
Durandal	Bldg.	Normand	France	180	300	....	26	100	..	1 9-Pd. 6 3-Pd.	.....
No. 11	"	Union Iron Works	U. S.	210	273	5600	30	..	..	4 6-Pd.	3

DISCUSSION.

Lieutenant E. W. EBERLE, U. S. Navy.—I have read with much interest the paper by Lieutenant R. C. Smith, U. S. N., entitled "Torpedo-Boat Policy," and it is a very instructive history of the evolution of the torpedo-boat.

I agree with the policy of the essayist in attaching great importance to the torpedo-boat, especially in harbor defense, but I regret that he did not designate the swift ram as the "running mate" of the torpedo-boat in this noble work of "aggressive defense." Of equal importance is the torpedo-boat destroyer, its duty being principally with the fleet along the enemy's coast, or upon the adjacent sea to insure the battle-ship against surprise by torpedo-boats.

My opinion is that the appropriation for each battle-ship or armored cruiser should contain a provision for two torpedo-boat destroyers. These two "destroyers" should attend the battle-ship during all manœuvres, and in time of hostilities they should serve as her "faithful watch-dogs" at night, being always on the alert for torpedo-boats and rams. The service that these "destroyers" could render a fleet of fighting ships would prove most valuable—some on the scout and others on the lookout. They could form an inner picket line for the fleet, the outer line being formed by the large cruising scouts. How much more

secure and comfortable the fighting ships would feel, when on the blockade or when approaching the enemy's coast, if each one had two effective torpedo-boat destroyers to insure protection from the ever-dreaded little "night-prowling" torpedo-boats. The two "destroyers" should be a "part and parcel" of the battle-ship and under the orders of her commanding officer; and they should look to the battle-ship for all supplies when cruising and also for protection from the enemy's fighting ships. During action they could often find safety under the unengaged side of their powerful protector and be ever ready to dart forth to repel the onslaught of torpedo-boats. To each coast-defense vessel should be attached one "destroyer" in addition to the number of torpedo-boats that should always accompany a fleet of coast defenders. Thus, for example, a fleet of six monitors should have six "destroyers" and probably eight torpedo-boats and two rams; the "destroyers" would act as scouts and as protectors against the "destroyers" or torpedo-boats of the enemy.

Torpedo-boats should never put to sea excepting to go to the assistance of an engaged fleet a few miles off the coast in comparatively smooth weather; they are really "pure and simple" harbor defenders, and in this valuable service they should always have the rams as their companions.

I think that we have seriously overlooked the great importance of the ram and torpedo-boat in harbor defense. For the purpose of illustration, take the harbor of San Francisco and assume that it has no fortifications whatever, no mines and no torpedoes in its approaches; but let the enemy be aware that within that harbor are about ten torpedo-boats and several rams and "destroyers." Would any commander-in-chief dare enter that harbor with his battle-ships and cruisers? Would he not realize that these little "night-hawks" and rams were hiding in every cove and behind every island within that large bay, ever ready to dart forth at his powerful fighting ships in the darkness or fog and then run for cover behind the many inviting islands? I do not believe that any commander-in-chief would dare imperil his fleet by entering such a harbor, or at least not until he should send in his "destroyers" and they prove capable of driving the little defenders into the shoal waters of upper San Francisco Bay for safety—a somewhat difficult feat to accomplish.

What is true of San Francisco Bay is true of many harbors on our eastern coast, and the illustration goes to prove that torpedo-boats and rams are very important in the defense of harbors, and at the same time it shows that the only way to overcome such opposition would be to have a large number of "destroyers" with the fleet.

I consider the ram to be as important in harbor defense as the torpedo-boat, and they should always be associated; and the ram should also be an important factor in the cruising or in the blockading fleets.

The "moral effect" that torpedo-boats and rams would have upon the enemy would alone be sufficient remuneration for their maintenance; they would prove a constant source of worry to commanders of fighting

ships, because it is realized that these little vessels are ever ready to dart through the darkness and sacrifice themselves in attempts on the life of the huge battle-ships, and though unsuccessful in the attack, the sacrifice is praiseworthy.

In my opinion, torpedo-boat destroyers should be well-built swift vessels of at least 300 tons displacement, of large coal capacity, and with an armament of one twelve-pounder and five six-pounders, or one twelve-pounder, three six-pounders and two three-pounders, *and with three torpedo-tubes* on central fore and aft line.

The torpedo-boats should be more cheaply built, as their chief usefulness is in harbor defense and a fair percentage will be destroyed by the enemy. The torpedo-boats should be of 130 to 180 tons displacement and carry four three-pounders and two or three torpedo-tubes on central fore and aft line, according to size of the boat.

I agree with the essayist in doubting the efficacy of search-lights on "destroyers" and on larger torpedo-boats. I think that the lights would do more harm than good if used in the chase or in attempting to pick up other torpedo-boats. Search-lights on large vessels, which furnish a steady platform and which move with comparatively slow speed, do not give the desired results in clear weather over ranges of much length, and in misty weather they prove utterly worthless. Therefore, as torpedo-boats would naturally take advantage of misty and foggy weather for attacks, the "destroyer" would find its search-light a useless encumbrance, even when not considering the other drawbacks of high speed and unsteady platform.

I think that Captain Evans' suggestion, as stated in the essay, for towing a target in torpedo-boat practice, is a very excellent one, provided the target representing the cross-section of the torpedo-boat is lashed across the gunwale of one of the old condemned sailing launches or other boats that are lying in the sheds at navy yards. This would eliminate the possible collapse of the target when towing at high speed and would permit the towing torpedo-boat to use her highest speed.

When carrying out such practice attacks, why would it not be well for the towing torpedo-boat to fire a torpedo or two, when within range, at a target of suitable limits anchored just astern of the vessel to be attacked? Then, if the target in tow is not hit by a shell while passing through the same zone that the towing torpedo-boat was in when she fired her torpedoes, the torpedo-boat has been successful, provided the torpedoes she fired struck within the limits of the target fired at. If the target in tow is struck by a shell, then of course the torpedo-boat's efforts are thrown out, unless she fired an effective torpedo when at a greater range than that at which her tow was struck. This method, I think, would produce some very interesting results, as it would give the opportunity to fire torpedoes and have the section of a torpedo-boat fired upon while under conditions of actual attack. The only element wanting is that you do not surprise the attacked vessel, unless you have targets anchored both ahead and astern of the vessel to be attacked and allow the torpedo-boat to tow across bow or stern from any direction.

If the torpedo-boat gets a shot on the target before she is discovered she wins, whether her tow is struck later or not. This would give all the conditions that appertain to actual warfare.

I do not agree with the essayist in his assumption that battle-ships should be fitted with torpedo-tubes, and I also consider that torpedoes are out of place in armored cruisers and in large cruisers designed to be used as scouts. I regret that I have not the opportunity here of showing that "battle-masts" or "fighting-masts" in a battle-ship are also a menace to the fighting qualities of the ship. I cannot imagine any circumstance under which a battle-ship would dare use her torpedoes, unless it would be to give the "knock-out blow" to an already defeated and disabled enemy before he could lower his colors; and it would seem poor judgment to approach within torpedo range of an enemy that is already whipped, because *he* might possibly have an uninjured torpedo-tube and that would put both vessels upon an equal footing again, thus possibly throwing away the victory that previously had been won.

Cruisers will use their high speed to avoid engagements with battle-ships, and, therefore, battle-ships will in most cases be opposed by battle-ships or armored cruisers. In such engagements the battle-ships would probably never be within torpedo range of each other, and if by chance they should close to 800 yards, would any commander dare open his broadside torpedo ports and attach the war-head in the face of the terrific fire of his opponent's numerous rapid-fire guns?

A better target for rapid-fire guns at 800 yards than an open torpedo port in the armored side of a battle-ship could hardly be desired, and if the "men behind the guns" fail to explode the air-flask or war-head, they would most certainly destroy the tube itself. Consider the Oregon, for example. She has a bow tube, a stern tube, two starboard broadside tubes, and one port broadside tube. Her bow and stern tubes are fixed, and as they are not protected by armor, they may as well be eliminated from the discussion. The broadside training tubes are behind four inches of armor, which offers little protection against the main battery of a battle-ship. Besides, the broadside tubes could not be opened except in smooth water; the bow tube could never be used when under way excepting at very slow speed, a speed at which the Oregon's helm is of so little use that she must be handled with her engines. It is claimed from experiment that war-heads will not explode when struck by rapid-fire shell unless the small detonator itself is struck; but would any commander of a battle-ship be willing to stake the fate of his ship in battle upon this assumption, merely for the sake of obtaining a chance shot at the enemy, provided his tube and air-flask have not already been penetrated? I do not believe that any commander would so menace his own ship, when in action, as to open his torpedo-ports and attach the war-heads as long as he could fight a single gun. If every gun has been silenced and the enemy should be so indiscreet as to approach within short range, a torpedo might possibly prove successful against him; but when a ship has been so seriously battered as to have every gun disabled, it is hardly possible that her torpedo-tubes remain unin-

jured behind only four inches of armor, not to mention what would occur when the torpedo-ports are opened and the tubes exposed to fire. In my humble opinion, torpedoes in battle-ships, in armored cruisers and in scouts are out of place and are a menace to the ship that carries them, and I believe that in the near future our policy will be: *Torpedoes in torpedo-vessels and in nothing else.*

I do not agree with Lieutenant Smith in his statement that vessels of the Yorktown class would make "efficient scouts" if "stripped of their heavy guns, etc." The scout must be large, with high speed, large coal capacity and excellent sea-going qualities, because a scout's duty is to pick up and keep in touch of the enemy in any state of weather, and then run for the fleet. Scouts are not fighting ships; they are the information bureau of the fleet, and their reports enable the commander-in-chief to tell *when* and *where to strike the enemy.*

I may well quote here the splendid words of Commander Goodrich in his discussion on page 555 of the Proceedings. Referring to the scout, he says: "She should be large, for with increased size comes increased steaming radius and the ability to proceed in heavy weather. She should not have torpedoes, for her duty is to observe and report, not to fight. Her safety lies in her speed."

Lieutenant H. O. RITTENHOUSE, U. S. Navy.—I desire to express my appreciation of the work done by Lieutenant Smith in the study and preparation of his subject, which is at once opportune and important in the highest degree. He has done pioneer work in clearing for us a confused and tangled field, a field, too, upon which, from the present outlook, the action seems certain to depend in large measure. Further than this, he has clearly indicated the lines of policy and construction that it would seem wise to adopt. For my own part I find it difficult to avoid his conclusions upon any point. At any rate, he has so set the facts in order that debate can be kept directed to the issue, and there can be no excuse for delay in settling upon a plan of construction.

Neither should there be delay in commencing construction. The signs of the times are decidedly unfavorable to any further pursuit of that wary policy of inactive watchfulness to which our legislators are so partial. (Let us hope the country may never experience the full measure of its economy!) We need immediately a strong fleet of torpedo-boats to operate from and guard our harbors; and the fleet needs high-sea torpedo-boats for its defense. That systematic and business principles directed to the sole purpose of armaments and the end of battle should be followed in their design and construction, admits of no argument and should need no advocate. It is difficult to conceive of a spirit in such matters that would prefer self-interest to patriotism. These boats, even if not directed against an enemy, would more than compensate for their cost in the experience they would afford officers in the navigation of our pilot waters, in cultivating sea prevision and resource, and in developing trained crews with experience and intelligence available for the most exceptional service.

I am heartily in accord with the essay in the moderate value assigned to the last few increments of extreme high speed when the advantages are weighed against those of other desirable qualities. The value of the last knot is about inversely proportional to the power that gains it, and a sacrifice equivalent to this power is inevitably involved.

Ensign R. H. JACKSON, U. S. Navy.—This essay, a review of the history of the development of the torpedo-boat, showing the tendency of present practice, followed by a logical deduction of the types to be used in the future, with special application to our own service, seems only open to criticism in admission of a third special type of vessel to assist the torpedo-boat as a scout. It is thought that the Desperate type, *i. e.* the destroyers, could perform this duty, assisted at times by such cruisers as might be available for scouting duty.

The selection of an enlarged Cushing or an Ericsson, with broadside tubes only, for the operations from a shore base, and a Desperate for operations with the fleet or at a distance from base, should cover the two distinct fields of torpedo-boat warfare.

A few suggestions, though not within the limits of the essay, are submitted as bearing directly upon the "Torpedo-boat Policy," viz. the minimum number of boats required of each type, the stations assigned, the *personnel* and organization.

1. Number and station: 50 Desperates and 100 Ericssons equally distributed to the following stations: (*a*) Long Island flotilla, covering coast from Boston to New York; the great commercial advantage as well as the strategical importance of a canal across Cape Cod neck would indicate that this undertaking will not be much longer deferred. This would bring Boston into the Long Island Sound district.

(*b*) Bay flotilla, New York to Florida, covering the Chesapeake and Delaware bays and interior communications.

(*c*) Gulf flotilla, from Key West to the Rio Grande.

(*d*) The Pacific flotilla, equally divided between San Francisco Bay and Puget Sound.

The boats to be assigned to the different naval stations within the district, and each boat allowed a section of a store-house in which spare parts and extra supplies are kept. The accounts to be kept at the station, and stores issued on stub orders. At present it requires almost the entire time of one officer to keep the books, make out the requisitions and returns and look after the correspondence.

The successful results attained in use of liquid fuel would point to the early adoption of it, with all the advantages of steam at short notice, smokeless combustion, rapid supply of fuel at stations, and reduction of complement of crew.

In connection with this station system too much emphasis cannot be laid upon the great gain that would result from standardizing as thoroughly as possible these boats, that suitable supplies and spare parts would always be available, and that crews may be immediately familiar with a boat when transferred from one to another.

While a boat might be sent to another station than her own, it should

only be temporarily. The whole history of the boat should belong to one station and locality. When a boat is left with a reduced crew, her stores and equipment would be placed in her own store-room in readiness for active service at a few hours notice.

This reduced crew to consist of a chief gunner's mate and a quartermaster on deck, and a chief machinist and oiler in engine-room. At no time should these men be detached from the boat. Their knowledge and exeprience are invaluable in breaking in new crews and in getting the best results from a boat in a short time.

With these four men on board, a new crew could be drafted to a boat and a successful attack be achieved that night.

These billets would be eagerly sought by men from the station to which the boat is permanently assigned.

An officer in charge of the boats of station, to take each boat out at certain intervals to test her efficiency, drawing men from other boats and receiving-ship for temporary duty.

On active service the officers for a destroyer to be a lieutenant, an ensign and a past assistant engineer.

On the first-class torpedo-boats, a junior lieutenant or ensign only; a midshipman or ensign might be added for specially arduous service or to make up casualties.

Whereas the number of boats required is based upon the probable demands in time of war, yet were these boats only fitted for peace service it would be a most excellent investment, in the instruction that they afford officers in pilotage, navigation and seamanship, with a knowledge of the coast and harbor possessed only by a few officers on the Coast Survey.

Above all, the responsibility of a command which the present generation knows only by tradition.

Lieutenant-Commander J. C. WILSON, U. S. Navy.—The service generally is very much indebted to Lieutenant Smith for placing before it such a clear and comprehensive history of the development of the torpedo-boat and submitting such well-considered suggestions and opinions as to their uses. It is a policy which I believe is less generally understood in the service than almost any other policy appertaining to the use of naval means of attack and defense. The various kinds, sizes, armaments and uses of torpedo-boats have changed so rapidly and multiplied so steadily that the average naval officer has had neither the time nor means of keeping up with the development and the history of failures and successes; so this essay is not only interesting, but exceedingly valuable to enable us to bring our knowledge of the subject up to date. I agree with the essayist as to the doubtful utility of the search-light afloat either for attack or defense in any torpedo-boat work. In general, I believe the importance of the search-light afloat to be overestimated. It should be of great service on blockades, when the vessel carrying it does not expose herself to attack by its use, and it probably would be used to advantage in searching out positions along the coast. Its necessarily exposed position and limited range bring it within range of all

rapid-fire guns, and makes it probable that it would be "knocked out" very shortly in any engagement in which rapid-fire guns played a part.

I think the essayist has shown conclusively what classes of torpedo-boats we should provide for our service, and that unless a systematic, intelligent course is pursued we will find our navy saddled with a lot of unsuitable boats. I agree with him in his deductions that but two classes (not counting the "videttes") can be properly utilized, and in any event we should first determine exactly what we want to do with our boats before building them.

It is time a settled policy of construction was entered upon and vessels constructed accordingly. The country has a right to expect that money and valuable time will not be wasted on construction of "misfit" vessels, and it would seem that the essay by Lieutenant Smith comes at a time when just such light is needed on the subject of torpedo-boat construction.

Lieutenant-Commander RICHARD WAINWRIGHT, U. S. Navy.—The Naval Institute is to be congratulated upon its Prize Essay for 1897. The publication of such an essay cannot fail to strengthen the support of the Institute, while it places before the navy a consistent torpedo-boat policy.

Lieutenant Smith first gives a concise history of the evolution of the torpedo-boat; then points out the special objects for which torpedo-boats should be designed, and, having thus outlined the qualities that have been obtained under various limitations and the qualities desired for the uses designated, proceeds to deduce logically the types that should be selected.

The essayist says: "If a board will first decide exactly to what use the boat is to be put, and what armament, speed, coal endurance and crew she will require for such use, then the displacement and horse-power will follow naturally. . . . If any other method is adopted in producing these boats, then when they are finished it will have to be determined what can be done with them." This may be said of all classes of vessels. Shall we consider to what use the vessels are to be put before designing and building them, or shall we build first and then determine what can be done with them? Shall we have a construction policy, or shall we continue to build our vessels and boats, here enhancing one quality and there another, at the expense always of some other qualities not as popular at the time, or coming under a bureau for the time being less persistent, and then turn this illogical product over to the naval officer to classify and utilize?

The question of a naval policy is a complex one, and it would not be sufficient to have a board to decide upon a type of battle-ship, another upon cruisers, and still another upon torpedo-boats. This no doubt would give us a homogeneous fleet and, therefore, a more effective one than if we adhered to the haphazard plan; but it would not prove the most effective one that could be produced for the expenditure, unless the entire question of the use of a navy to the country is considered, and the qualities required to accomplish these objects and then the types designed to develop the qualities. By this means we would settle many disputed

questions and select from the numerous types the few that are needed. We would find that the principal use of the navy was to defend the coast and commerce of the country. We would define the difference between coast and harbor defense; define the limit between the mobile and immobile forces. We would settle the question between the battle-ship and the monitor. We would cease to advocate fortresses as safe refuges for our weak fleets, and cease to advocate battle-ships of light draught to enter the shoaler ports. We would remove the cloud that now obscures "the fleet in being" and would find that "a passive fleet in being" has few terrors for an active opponent; that the harbors are no place for battle-ships, and that battle-ships alone are suited to fight battle-ships in line. We would find that but a few of the harbors of our coast need defense against battle-ships; that but few need a powerful defense; that the most important points to defend are the advance naval bases; that we need a type of battle-ship to fight the battle-ships, a type of cruiser to collect information and to fight the enemy's scouts, and types of high-sea and base torpedo-boats. We might even settle the vexed question of the *raison d'être* of the armored cruiser and find that a vessel without the fighting endurance obtained from some side armor was useless for scouting purposes, and that auxiliary cruisers make the best commerce destroyers, thus erasing the unarmored cruiser type from our list.

Lieutenant Smith, in considering the general qualities, advocates strengthening the bow, even at the expense of speed, of the smaller type; and one of his conclusions that might be open to question is whether or not it might not be wise to add some protection to the high-sea type. Many torpedo-boats carry three-pounders, and while they are on a very unsteady platform, it would seem as if two or three torpedo-boats might be able to stop one destroyer if the engines and boilers were only protected by coal. This armor might be obtained by a slight sacrifice of speed or a slight increase in tonnage; the latter would entail a slight loss of speed. Whatever conclusions may be reached on minor points, the main points of the essay fixing upon two types for torpedo-boats are based on sound reasoning.

Assistant Naval Constructor R. B. DASHIELL, U. S. Navy.—Lieut. Smith's essay is most interesting, and at the present time a more important subject could not have been selected. He has clearly demonstrated the principle, what might be called the fundamental axiom of torpedo warfare, that the unprotected torpedo is a surprise weapon. With this always in view, the following conclusions seem self-evident:

(1) The torpedo-boat must be as small as possible, to obtain a degree of invisibility and immunity from discovery.

(2) She must be not only speedy, to run in quickly to torpedo range after discovery, but must have machinery capable of attaining her maximum speed instantly upon discovery.

(3) She should carry the best torpedo outfit possible, for this is her weapon, and only such guns as would enable her to overcome a vidette boat.

(4) As the chances are against her ultimate escape after attack, she should be as cheaply constructed as thorough efficiency will permit.

All these qualifications point to a small size boat. The Ericsson type seems to fulfil all requirements for such a boat, as the essayist clearly shows. But a change in her armament of guns is suggested. With nearly all our other boats, she mounts the 1-pdr., a gun which has been recently shown to be utterly powerless to stop a torpedo-boat (much less a destroyer) by injuring her vitals. This gun is therefore so much dead weight to carry about. Though possessing greater penetrative and mining power than the 1-pdr., the 3-pdr. (with ammunition) is just four times as heavy, requires more men to serve it, greater deck room, and will score fewer hits, while its recoil is so vicious in its strains upon fastenings (which must be made extra heavy to meet such strains) that all things considered, the actual value of the gun compared to the price paid for its emplacement becomes exceedingly small.

It would seem, therefore, that the machine gun is the best arm with which to check interference from vidette boats that cannot be rammed and overrun. It is light, can be mounted anywhere in a convenient socket, requires but two men, and the hits scored will be fifty to one of the single-shot gun.

Such a boat can be built for under $100,000.

Turning now to the larger type of boat, a vessel of 250 to 300 tons, the first question that presents itself is, what are the advantages possessed over the 120-ton boat? The essayist seems to select the type for the increased sea-going qualities and the ability to mount a heavy gun battery. But if the nature of our coast and the character of the defense are considered, our ports appear as the natural shelters from which the boats would make their attack. The weather must always be selected, and, as the essayist states, if the sea is too heavy for the boat to manœuvre it is unfit for torpedo work. Therefore the small boat would evidently do the work as well as the larger, her sea-going qualities being fully equal to the duty required of her.

The next consideration is the ability to carry a gun armament, presumably to destroy the enemy's boats. Her value as a destroyer depends upon the probability of torpedo-boats ever forming an important part of the hostile fleet in an attack on this country. To reach the coast there is broad water to cross, and it is not reasonable to anticipate attacks with torpedoes from any but able sea-going boats of the destroyer type, capable of accompanying the fleet at sea in all weathers. It is not wisdom to meet destroyer with destroyer; the gunboat and cruiser must be depended on to crush that type with heavy gun fire from a platform the comparative steadiness of which guarantees good gun practice. If then there be few or no torpedo-boats in the enemy's fleet, why build destroyers for the defense? Other countries are building them, but their policies, their geographical positions, are very different from ours, and their types of weapons will consequently be different. With France at convenient distance for torpedo-boat raids, England naturally builds her 98 destroyers to match the 241 French torpedo-boats. The destroyer type thus becomes a most successful and popular one, and the smaller countries of Europe and South America copy them in their orders for boats, which orders are generally placed in England. But these are not

reasons why the United States should follow the same policy. What this country needs is a *large number* of torpedo-carrying craft; the value of the arm is directly proportional to the number of craft; if *five* sea-going 120-ton boats can be built for the same price as *two* 300-ton boats or destroyers, and appropriations are limited, can there be any question as to the type to be selected, both types being equally efficient for torpedo work?

The third type of vessel upon which torpedoes may be reasonably installed is the heavier cruiser or battle-ship, where the tubes are below water or protected by armor. In such vessels the torpedo is not a surprise weapon, but is used with the full knowledge of the enemy and with the ship fully exposed to counter attack against which no skill or protection can guard. Is such jeopardizing of one's ship permissible? It seems most foolhardy, most unreasonable. The art of war is to overmatch and crush an enemy by massing superior force on a weak point, *not* to match equal with equal and trust to luck for the result.

The over-water tube even behind armor is not protected, and before torpedo range is reached and after the gun contest, the fittings of port, tube, etc., will not be likely to be found in working order. Add to this the great additional weight of the torpedo installation, the cutting of large holes in the ship's side armor—armor placed there to protect her buoyancy—and the relief to the mind of the commanding officer not to have the additional complication of torpedoes to bother him, and there seems but little reason left for retaining this weapon on a vessel whose main offensive power lies in her guns. Indeed, for no other reason than the last given, the removal of torpedoes from all vessels but torpedo-boats might be advocated. The strain thrown upon hull and machinery under forced draught to obtain high results is as nothing to that imposed upon the brain of a captain going into action with all the complicated machinery in the conning tower to run, his tactics to think out, the enemy to watch. The conning tower is so crowded with steering gear, engine annunciators, torpedo directors, range finders, range indicators and similar interesting toys that the men to run them have no standing room at all.

Is there a commanding officer in the service who would not be glad to see a few of such "clock-works" removed? If there is such, he would change his mind after a few experiences of steering a course, getting under weigh, or handling the ship from the conning tower alone. So let us clear out at least the torpedo-directors, torpedo speaking-tubes, telegraph and firing keys, and give the *brains* of the ship a chance to think.

The wooden vidette launch to be carried by the bigger ships is most heartily endorsed; it is just the type of boat most needed in the service. But if a higher duty than 12 knots be required of her, she will be much lumbered up with machinery and boilers.

In naming our boats, are not the names of our venerated admirals far more suitable to a vessel of the worth and dignity of a great battle-ship, and their personal qualifications more in keeping with those of such magnificent machines, than for such dashing craft as our gallant little

boats? The chief *personal* (for the boat to a sailor is a living thing) characteristics of the torpedo-boat are youth, dash, ready sacrifice. If personal names are to be employed, are there not enough Cushings, Flussers, Talbots—enough of the all-but-forgotten names of midshipmen, ensigns, lieutenants, who have given their lives for their country, to give to each boat a *young* hero's name—*pour encourager les autres?*

Wm. Laird Clowes.—It is a matter of regret to me that pressure of work prevents me from devoting to Lieutenant R. C. Smith's interesting paper the time and attention which his subject, and his manner of treating it, deserve. With the recapitulation of his conclusions as to the Torpedo-boat Policy to be pursued by such a power as the United States, I most cordially concur. At the same time I venture to think that perhaps he has not sufficiently underlined the importance of the work to be done in the naval warfare of the future by a modified Polyphemus or Katahdin; and I also venture to think that, incidentally, he gives somewhat too much importance to the ram. Of course, if only you *can* ram you are likely to inflict fatal damage upon your opponent. On the other hand, experience tends to prove, firstly, that you cannot, as a rule, ram effectively until your opponent has been rendered practically harmless and has ceased to be under control, unless indeed she be without room in which to manœuvre; and, secondly, that when you do ram effectively, you are extremely apt to do almost as much damage to yourself as to your foe.

Those are points to be carefully considered ere you set to work to build rams, with or without torpedo ejectors on board of them.

Upon the general question of the best type of torpedo-boat for war service, it is pertinent to bear in mind that although a torpedo-boat, or even a destroyer, is, relatively speaking, an inexpensive craft, and that though her expenditure in action would mean at worst no very appalling loss of life, she is, as at present built, a risky and dangerous weapon. She has her torpedoes on deck exposed to the possible rain of missiles from machine and rapid-fire guns, and should a stray shot strike an air-chamber or a torpedo's nose, the most fatal results are likely to follow.

Would it not, therefore, be worth while to add, or, rather, to prefix, to Lieutenant Smith's list of most desirable torpedo craft something like the following: Let us imagine a very handy vessel with a well-armored turtle-back like that of the Polyphemus, yet thicker, with twin screws; with only light guns; with no ram; and with a couple of submerged tubes on each broadside. A speed of 18 or 19 knots, sufficient to enable her to keep up with a fleet, would be enough. She would be almost impervious to gun fire, and she would be deadly to anything within 500 yards of her. She would use her guns only to keep off and disable other torpedo craft, and even if all her guns were put out of action, she would be offensively as formidable as ever.

I believe that this is one of the torpedo vessels, if not *the* torpedo vessel, of the future. The other types recapitulated by Lieutenant Smith appear to have their places and duties for the present, but when the new type of which I speak appears it would be practically supreme. The new

type, I admit, will not be comfortable to live in unless means be adopted for submerging her only just when she is needed for action, and for enabling her, when cruising, to float high; but those means could be easily devised. Another point apparently worthy of consideration seems to me to be that the adoption of such a vessel as I describe would obviate, at least for a time, the need for making further costly and dangerous experiments with submarine boats. I am no believer that the latter will develop into efficient weapons for many years to come. In their imperfect state I grant they will possess a normal power of great value; but so also will the armored and approximately shot-proof boats which I advocate. And the latter are both cheaper to build and safer for their crews; while, moreover, there can be no question as to the possibility of making them do all that they are wanted for.

Naval Constructor Wm. J. Baxter, U. S. Navy.—The author deserves congratulation upon the able manner in which he has presented to the Institute the results of his researches and experiences. The mass of facts showing the development of the torpedo-boat has been presented in a style and with a completeness beyond question, and those who have never attempted similar researches cannot conceive the labor involved in producing results which so concisely and clearly represent the progress of naval construction in this direction.

It is to be regretted, however, that he was unable to carry his investigations further and record the results of service use upon foreign torpedo-boats of the various types. From papers, periodicals and our own Naval Intelligence reports, we know that many defects of design and detail have occurred. The defects of design are eliminating themselves as development expands along specific lines, but the defects of detail are rarely mentioned. Has not experience shown that simplicity is even more desirable and necessary in the torpedo-boat than in the battle-ship? Leaving all other considerations aside, may it not be considered an absolute necessity that on small boats where it is necessary to change the crews every three or four days, every part and fitting of armament, machinery and hull should be of such simple construction that the average seaman may learn how to efficiently operate them after a few hours instruction?

I greatly sympathize with the author's plea for some standardization of torpedo-boats, for it is precisely in the line of improvement which I have at other times endeavored to show is one of the most urgent and important questions to be solved in the near future, and some considerable experience with ships of the "new navy" has accentuated my former beliefs. The author's proposed method of having a board "decide exactly as to what use the boat is to be put" cannot be considered as his deliberate opinion, for he and all the rest of us know very well that no board can decide upon this question, as the exigencies of the service to-morrow will be entirely different from what they are to-day. A suitable board of experience and ability can decide as to the probable uses of any type of vessel during the next one or two years, but experience should also cause them to consider the probable changes which will occur during the

next three or four years. Fads may be very well as a pastime, and they have done much in the development of the new navy, but the probabilities are that the fad which is the most popular the day the ship is designed, and which is the most artistically developed on a draughtsman's *chef d'œuvre*, that this fad will be most criticised, and will be the least serviceable when the ship is completed and subjected to service conditions.

Wise conservatism and intelligent simplicity are, and should be, the ruling principles with us, and I heartily concur with the author's efforts to secure them, although we may differ as to the methods.

Lieutenant PHILIP ANDREWS, U. S. Navy.—Lieutenant Smith's essay on torpedo-boats comes at a most opportune time, and is a very exhaustive technical compilation of the features of torpedo-boats and destroyers.

In view of Mr. Smith's extensive experience with the Cushing and with torpedoes, I am sorry that he did not give the Institute more of his opinions and conclusions, in addition to the large amount of data which he presents in this convenient form. I should like to hear more about the handling and tactics of the completed torpedo-boat, in groups or singly; features which interest the sea-going officer more than the development of the boats.

There is one feature to which attention should again be called: the advantage which would accrue by cutting a few more canals along our Atlantic coast. A canal across Cape Cod peninsula, for instance, would be but nine miles in length, would cost little, and would give tremendous advantage in the use of a small torpedo flotilla. It would also, if made big enough, cut off the rough and foggy trip around Cape Cod in going to Boston. There are several other points where canals should be cut, but the Cape Cod canal is instanced as probably the most important example.

This subject should be agitated through the commercial interests affected till legislation is secured. There is no more important feature of the conduct of a torpedo flotilla on our eastern coast than the most complete inland water communication.

(*Discussion continued on page 153.*)

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

INTERNATIONAL ARBITRATION: HOW, AND HOW FAR, IS IT PRACTICABLE?*

By HON. JOHN A. KASSON, LL. D.,

Former U. S. Minister to Austria, to Germany, etc.

INTRODUCTION.

It is not so very long ago that the naval commander strode the quarter-deck of his ship and looked at his hundred guns with something of the air, and of the manner, of a champion of the ring. He utilized his guns very much as the champion employed his fist. If he wanted an island in the Spanish Main, he knocked down its defenses and took possession. If he wanted some treasure from South American mines, he captured the galleon which transported it. If a merchant of his country wanted a port, or a trading post, which was occupied by a national rival, he sailed in, shot down the stockade, and seized the place. If a foreign tribe or people had no wish to buy the rum, or the opium, exported by his countrymen, he delivered a few broadsides of cogent argument to teach them their duty in swallowing the offensive doses of his national merchandise. If a neutral and weaker fleet lay in its harbor where his enemy might possibly utilize it, he ranged alongside and took possession of it, to teach them the folly of being neutral when a fight was going on. If a naval or commercial rival was forging ahead too conspicuously, he was only too eager to make the ocean dangerous for a rival's navigation. The presence of his flag was a challenge to fight. His national interest was his international law. His joy was in a windward position, the roar of his guns, and the crashing of naval

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timbers. His courage was reckless, and his cockpit was a butcher-shop.

The nineteenth century, now closing, has gradually introduced a change of scene. The motive power of the ship, and of the officer, has very radically changed. Fickle winds, and a fickle national morality, have given place to a steady propelling power for the war-ship, and a compelling moral principle for the naval commander. There is now an admitted dominion of law over the high seas. It is acknowledged in ports, and protects trading posts and traders even along the Congo, and into the far interior of Africa. The man who treads the quarter-deck is trained in knowledge of this law, and in a scientific school; and is a master of the rules of national morality, as well as of the forces of nature. He seeks to protect human life more than to destroy it. His blows are aimed at the inanimate vehicle rather than at the men whom it carries. The cockpit is a protected hospital instead of a depot of carnage; and anæsthesia converts the knife of the surgeon into a painless instrument of mercy. Neutrals keeping within the law are no longer outraged, and the sea has fewer criminals than the city. International justice is a part of the education required for the quarter-deck. Even diplomacy has left its narrow and secluded lanes, and travels with our fleets. Naval commanders in distant seas have negotiated and won for us new harbors for our ships, new stations for their supplies, new ports for our trade; and new nations, like Japan and Corea, for our commerce and our friendship. In a word, the undercurrent has been toward conditions of peace.

Throughout most of this immense advance to a better condition of the world, the Government of the United States, by their judicial courts, their diplomacy, and their navy, have led the way.

There is, however, a further advance in international civilization for which our Republic has attempted to blaze the path through a forest of difficulties. It is to establish a method by which differences between nations which the usual diplomatic agencies fail to adjust may be honorably settled without a resort to war.

At first blush it seems incongruous to address the members of the war-making department of government upon the means by which their active employment may seem to be rendered unnecessary; but I cannot forget that their arms have often been used

in aid of a higher civilization, and to secure honorable peace, and that their intervention in our times is much more often a guaranty of peace than it is a menace of coming war. The naval or military officer of our day (I think it may be safely affirmed) now regards himself as an armed guardian of international peace, not as a challenger to combat, impatiently awaiting the order to fight. The noble-minded Frederick of Germany responded to my allusion to his brilliant experience in three wars, that he "hoped he should never see another battle." In this I believe he spoke for all conscientious military officers of the Christian civilization. The intelligence and influence of such officers may also have great effect in helping their governments to a wise conclusion in respect to the limits within which a system of international arbitration may be safely adopted. For no man acquainted with modern history, and with the present condition of international relations, can (in this generation at least) indulge the dream of a practical scheme of arbitration which shall include *all* nations, or *all* the subjects between nations.

I shall, therefore, with the encouragement of the accomplished President of this War College, speak briefly to you upon this pregnant and much mooted question of international arbitration, and how far it is practicable.

"International Arbitration: How, and How Far, it is Practicable."

The Duke de Sully, who was the great minister of a great sovereign, and a philosophic thinker and statesman, and fully acquainted with Henry IV's plan for European peace, gives to posterity a needed warning against ill-considered enthusiasms. He says in his "Memoirs," "The mind of man pursues with so much complacency, nay even with so much ardor, whatever it fancies great or beautiful, that it is sorry to be made sensible that these objects have frequently nothing real or solid in them."

It is impossible to give a better definition of the danger to which the promoters of international arbitration are exposed. The idea of extending the judicial system, by which all the differences between man and man are peacefully adjusted, to all differences between the nations of the earth, and so abolish all the savagery and waste of war, is so captivating by its greatness and beauty that we are indeed sorry to be made sensible of the obsta-

cles in the way of its realization. But such obstacles of the most serious nature do exist; and the means for their removal, or for overcoming them, require deliberation more than enthusiasm. The idea is inspiring, like Constantine's beaming cross in the sky; the means of realization must often be a Constantine's imperial authority, and the discipline and force of his organized armies. That is to say, the Christian governments of our day, however earnest for the preservation of peace, must still be strong to enforce and to resist, or some warlike and ambitious power will strangle our peaceful offspring before its maturity.

It is most fortunate that the close of our century finds the United States, England, and France, three of the most powerful nations of the world, most prominent in civilization, and most competent in war, leading in the consideration of the means for the more constant preservation of peace by some system of arbitration or mediation. If the movement were entrusted to unpractical theorists, clamorous against armies and navies, or if it were urged only by weak and unwarlike nations, it would be wholly ineffective. The effort would simply invite the attention of the strong and grasping to their neighbor's weakness. It would be the hornless lamb walking into the herd of lions to remonstrate against their going about with such sharp teeth and cruel claws. The world has not yet reached a point of Christian civilization where a national lamb, without horns, can assure itself of peace anywhere among the lion herd, except inside the lion. Witness Holstein and Hanover, witness Egypt, witness Madagascar, witness South Africa, and Central and Southern Asia, events that have occurred before our own eyes. Americans must still believe the declaration of the father of our country, that in order to assure peace we must be prepared for war. A nation resolute for peace must be ready to enforce it. It must merit the eulogium which Mark Twain's hero bestowed on the mayor of a rough mining town in the Sierra Nevada: "He was a great man for peace, he *would have* peace even if he had to fight for it!" Europe owes the continuation of its peace during the last twenty-five years to that strongly armed mid-European league which was devised by the great statesman whose policy was named as "iron and blood." A mournful burden, I admit, is this costly preparation for war, but not so mournful as the dreadful visitation of war itself.

In the present conditions of international morality, we must approve the defensive armaments and armies of peace-loving nations, and justify their gallant sailors and their ships of war for the maintenance of the peaceful and the just against the warlike and the unjust. Both, in the state of affairs now existing, exercise the useful functions of a strong international police. They can only be abolished when international crime ceases; just as our civic police with their clubs and pistols can be disbanded only when criminals become righteous and peaceful.

There are some professional advocates of peace at all hazards, and at any price, who unhesitatingly ignore history as well as present national conditions. They broadly condemn all wars as acts contrary to the traditions of our religion. They forget that their own liberty to profess and practice their faith was secured to them by long continuous wars on land, and many bloody victories at sea. They should remember that neither the God whom we worship nor the Christ who gave the later Divine Word to the world condemned the army or the soldier. The former, according to the Prophets, raised up armies, and commanded them to war. The latter, instead of rebuking the military service of the Roman centurion, commended him for his faith, and gave him his blessing; and he only commanded the private soldiers to be contented with their wages, and to avoid violence to individuals and false accusations. Instead of assailing military institutions, needful in those times as they are in ours, he warned military men against their misuse, and so marked out the proper course of action for us.

Whether this be the true religious view of the military question or not, the paramount and controlling fact remains that it *is* the view of all the Christian governments with which we have to deal. If we proceed upon the opposite view we shall speak to deaf ears. It is folly to ignore the lessons of history. Hitherto God has wrought out the conditions of advancement in Christian civilization chiefly by the aid of armies and navies. Remember the Roman Republic and Empire which opened military roads and the world for the spread of Christianity; the military dominions of Constantine and Charlemagne by which it was protected; the military establishment of the Reformation, and of the rights of conscience and personal worship, by the heroic fighting of North Germany, and of Holland and England by land and sea.

Attest also the American Revolution in behalf of liberty; and our great war in the overthrow of slavery; and even the terrifying overthrow of European despotism in Church and State by the exploding forces of the French Revolution.

In the evolution and advancement of the soul and mind of man and of his civilization we have the correlative illustration of the successive creations and progress of the physical world. As the Almighty in the latter exceptionally employed the volcano, the earthquake, the tornado and the thunderbolt, acting outside the scope of ordinary and peaceful forces, so does He in crises of human progress make use of the violent forces in man to forbid the destruction of human right, and to establish justice. When this round continent is completed, earthquake and volcano will cease. When man's development is perfected, armies and navies need exist no more.

Our function therefore does not seem to be to encourage a crusade against armies and navies, against soldiers and sailors. It is rather to diminish so far as possible the occasions for employing them in actual war. This is a practical and practicable duty in which we are assured of our accord with the Divine will, and in which we shall have the sympathy of most governments, and the respect of all.

In what way can this good and Christian work be most wisely conducted? What is it best to do, and best to avoid doing?

It is decidedly unwise to attempt in the beginning to include too many nations in the same convention. Some of them have uncompleted national purposes, partly just, partly unjust, but which can only be accomplished by the free military arm. Russia, whether right or wrong, *will* have an open port within Corean or Chinese territory, and an open course to the Mediterranean Sea. Austria and Italy and Greece *will* assert their claims to a part of the European territory of Turkey upon the break-up of that empire. France will not relinquish her right to war for the recovery of her lost departments nor for her colonial expansion in Africa. Germany will not arbitrate her right to existing provinces won in her late wars. England will not arbitrate her right to colonial conquests, nor (for the present) the duration of her occupation of Egypt. The United States will not submit to any tribunal their policy initiated by President Monroe. Strong nations are as fond of their freedom of action in emergencies as

is the individual man in his personal relations. There are some nations and more questions which cannot for many years to come be brought within the scope of international arbitration. We must abandon as only a lovely dream of a far future possibility all idea of a universal system of arbitration, whether universal in respect to nations, or universal in respect to the questions to be submitted to arbitration.

The difficulties—I may almost say the impossibility—of embracing many nations in the same scheme were made apparent in the Pan-American Conference of 1890, the story of which is well worthy of remembrance in this connection. There were eighteen Governments represented in the Conference at Washington by accredited delegates. Every one of the seventeen continental and independent American Governments was represented, with addition of the insular Government of Hayti. Only one of the nations was Anglo-Saxon in origin, one was Franco-African, one Portuguese, and fifteen Spanish. Consequently it was necessary to reconcile many different hereditary opinions, political tendencies, and various intellectual training. One of the principal questions submitted to the Conference was that of a general system of international arbitration embracing the eighteen governments. The *projêt* of such a convention was indeed nominally adopted by the representatives of fifteen States; but the two most powerful and intelligent States refused their assent to it. They would have approved of the rule of arbitration in the majority of cases, but demanded that questions of independence and of national dignity and honor should be excluded from the compulsion of the act. With that condition they were willing to make mediation before war compulsory for all other cases. The opposing delegates were headstrong, and the *projêt* draft was adopted by a majority only, without the sanction of Mexico or Chili.

The second article of this Pan-American Convention made arbitration obligatory for a specific list of differences. The third article made it equally compulsory for all other disputes, saving only, by the fourth article, a controversy which a government may regard as imperiling its independence. Thus it was sought to bind the independent action of each sovereignty throughout all the unknown and unknowable conditions of the future, saving only this one right reserved by each to judge whether its independence was endangered. From a practical statesman's point

of view, it is not surprising that only the weaker governments afterward ratified an agreement so reckless of future contingencies. The majority declined all further action upon it. The United States Government itself never approved it, nor submitted it to the Senate for ratification. In compliance with a vote of the Conference our State Department transmitted the *projêt* to European Governments, by whom it was at once committed to their dusty files—*in memoriam*—in some cases without even acknowledgment of its receipt.

I have recited these facts as indicating that all attempts to establish an universal system of arbitration by a single contract including many nations, will be fruitless, and a vain expenditure of labor. Experienced statesmen will have nothing to do with sweeping generalities, binding their nations for an unlimited time and unknown future. Nations cannot be brought to such an absolute agreement by large groups. Their interests, hopes, and ambitions are too diverse to be covered by identical provisions. Two nations only, masters of the knowledge of their past, present, and probable future relations and disagreements, can be expected to provide permanently for submission of their differences to arbitration. Even in that case there is doubt if they will ever agree to submit all differences without reserve. There must be a specific list of those which shall be submitted, not a specific list of those excepted. That was a fundamental mistake in the *projêt* of the American Conference. Had they limited compulsory submission to certain agreed points, treaties between each of them and the United States might now be in existence.

Nor is it probable that for many years to come governments will see with sufficient clearness the character of the differences likely to arise between them to accept the ideal of a permanent court of arbitration. Among the objections to be offered to that theory is the need in many cases of technical knowledge which requires a special selection of arbitrators with reference to the points in dispute; the differing views of law and justice in which the lawyers are trained in the various countries from which the members of such a court must be chosen; and the dependence of such judges in several countries upon political direction. Such a tribunal might be more wisely appointed, at the beginning, for the purpose of preparing a code which should give definiteness

and precision to the rules which should govern a court of arbitration. After the ratification of such a code the trial court might be safely established.

Former Schemes for Maintaining Peace.

Often in the course of the world's weary history have men turned their attention from devastating war to the Christian prophecy of "Peace on earth, good will to men." Authors and statesmen, both the powerful and the powerless, have conceived various devices for the introduction of this hopeful era. But no such device has been self-executing; physical force was always arrayed behind it. The often quoted precedent of the Amphictyonic Confederation of Ancient Greece appears to have suggested most of these plans. But that institution was as much administrative as judicial. The limits of its power are not definitely known. It interposed between the twelve small kindred states composing it, and seems to have engaged at times in composing the troubles of individual cities. It certainly mediated between them, gave decisions, and enforced them by fines, by expulsion from the confederacy, and even by war. It is not therefore a model for the proposed system of arbitration between states of our civilization. We propose no scheme which requires the use of force, or any other form of physical punishment. Our only compulsion will be that of morality and honor, and the national shame which follows their violation. These are positive and recognized forces in Christendom as they never were among the Greeks.

Nor can the scheme of Henry IV of France, of which the honor of conception is divided between him and Elizabeth of England, furnish a model of any utility for our times and purposes. The most important part of their scheme was aimed at the dismemberment and humiliation of the powerful house of Austria, the spoils of which were to be distributed among princes and republics to purchase their adhesion to this project. When, by such bribery, followed by the contemplated war, they should have united the rest of Europe, and compelled the assent of Austria and Spain to the proposed reorganization of nations and new disposition of territory, then, and only then, was what he was pleased to call the great Christian Republic of Nations to be called into existence. The apportioned delegates of the associ-

ated governments were to meet in common council for the regulation of any dissensions which might thereafter arise between them. Even then it was not to be a simple council of arbitration in the interests of peace. It was to be an assembly with power to apportion assessments and warlike charges among its constituents for the purpose of prosecuting war against the Mohammedan power of Asia. The death of England's great Queen, followed by the selfish indifference of King James, was a severe blow to the scheme, such as it was. Henry, however, still prosecuted it, and was secretly gaining some adherents in Germany and the north, when the dagger of Ravaillac terminated the career of this most noble and picturesque monarch of Europe. With him disappeared from the historic scene that great plan for abolishing the occasion of all future wars between Christian nations by one great contest of mingled diplomacy and force for the redistribution of power in Europe. The project was appropriate to those warlike times, and it ennobled the fame of France by Henry's repudiation of all intention to profit himself by the dismemberment of Austria and Spain. But no part of the scheme offers an example for our times and international circumstances.

The Peace of Utrecht (1713) established new territorial relations and limits. In the period following these treaties the Abbé de St. Pierre, who had been present at the conferences, and knew the deplorable effects of the long wars in which Louis XIV had been engaged, published (1729) in three volumes a scheme for securing perpetual peace on the continent, with a voluminous argument in support of it. His plan seems to have been inspired by that of Henry IV, and assumed that the new international boundaries would be perpetual. According to him, each of the powers was to renounce the right of war against the others. An assembly of the delegates of all the powers was to determine the mutual disputes by a majority of three-fourths of the delegates. Nineteen principal governments were to have one vote each, minor states and free cities together to have one vote in this general diet. A refractory member was to be compelled to obedience by the combined arms of the others. The spirit of the good Abbé was commended by the good people; but the general verdict was that it was merely the "dream of a good man." A distinguished Cardinal said that the Abbé should have first provided for the conversion of men into angels.

Prerequisites of Universal Peace.

At that time neither rulers nor philanthropic prophets foresaw what God's providence was providing for mankind, even within a century, by the aid of wars more extensive and more disruptive than that generation had ever known. After some renewed hostilities on the continent and on the seas, the way was opened for our American independence; and this was followed by the revolutionary and dethroning wars of France against all Europe. The sequel showed how vain and transient would have been the peace system of Henry or the scheme of St. Pierre, both of which were founded upon the mere agreement of transient crowned heads, and upon the theory that transitory boundaries could be made eternal. There were moral forces, suppressed but fermenting, which must first find expression in the liberty of individual and national development before permanent conditions of peace could be established. The explosion in France prepared the necessary emancipation, and from that time on Providence has been more visibly working, even through wars, for the establishment of universal peace. Witness the necessary enlargement of the United States to the Pacific Ocean, the permanent union of Italian states, the consolidation of German states, the incorporation into Russia of Asiatic states, and the union of Central Europe from the Baltic to the Mediterranean in a defensive bond for the preservation of peace. The retrospect of the philosopher discovers in all these the divinely ordered preliminaries of national contentment, which is a requisite condition of permanent peace. If the declarations and labors of Americans are to have any influence upon the action of international statesmen, it is of prime importance that we show an appreciation of present national conditions, and recognize also the possibility of future international readjustments, unforeseen, but dictated by that higher power which we call Providence. We must neither ignore history nor the actual controlling motives of chiefs of states, and the desires of nationalities. Some nations are already territorially rounded out and completed; others are not. In some the aspiration for unity of race and language is satisfied; in others not. In some, national independence is firmly established; in others it is insecure or oppressed. No universal agreement, therefore, for the renunciation of the right of conquest, or

for unrestricted arbitration of disputes, can be expected at the present time. As each generation removes some of the obstacles. and more and more satisfies legitimate national and racial aspirations, there remains always the brighter hope of the future.

The United States, England, and France.

Several groups, however, of two or more nations, stand already in such relations to each other that their respective ministers could to-day wisely and safely entertain propositions for a permanent rule of arbitration, which should be binding on both in respect to the majority of their probable differences. Our attention will be most usefully directed to these groups, and more especially to those of which our own country is a constituent. For example, consider the two groups of nations composed of

First. The United States of America and the kindred nation of Great Britain;

Second, of the United States of America and their lifelong friend, France.

What are the conditions which render the proposed system of arbitration between the two States first named peculiarly practicable?

1. A like education of their people and of their statesmen in identical principles of law, of religion, and of justice, which predisposes them to a common judicial view of right and wrong. 2. A common language, literature and press continually interchanged, together with an unceasing personal, social, and commercial intercourse, which leave little opportunity for angry misconceptions to crystallize into hostile resolutions. 3. Both nations entertain common views of the duty which a Christian civilization owes to liberty and humanity. 4. For one hundred years they have been accustomed to settle all their extreme disputes, save one, by arbitration or reference, whenever unsettled by diplomacy. 5. Both nations have established an equal reputation for valor and persistence in war by land and sea, and each could inflict upon the material interests of the other enormous injury if the relations of peace were unhappily broken. 6. The many recent expressions of parliamentary and public opinion in both countries which have been formally and publicly exchanged, show that the time is consummately ripe for a general and permanent treaty between the States of this group for the arbitration

of most of the international disputes likely to remain after diplomatic negotiations.

Eighty years have now passed, not without troublesome disputes, to be sure, but happily without war between them; and so we may reasonably believe that the hostilities and passions of that period do not exist in the breast of men of the present generation. Should, however, some question again arise bringing the two nations into angry conflict, we might wait many years before again entering upon such an era of international amiability as that which prevails to-day. It is an obligation of the highest wisdom to do a right thing at the right time.

There is, however, one very serious embarrassment in the way of a satisfactory agreement with Great Britain. It rests in the differing views of the two Governments in respect to the obligatory character of what we call the Law of Nations. Our Courts and Government have acknowledged under that name the existence of an external body of principles and rules obligatory on us in our international relations, which have obtained their authority prior to and without our express national sanction, and which we must recognize and obey as a member of the family of nations. The English, on the contrary, deny the authority of these principles and rules until they are expressly adopted in Great Britain, either by legislation or by decisions of their courts. That is to say, international law must be expressly converted into the form of municipal law before it will be binding upon the British Government. A remarkable instance of this occurred in the time of Queen Anne, when process was allowed against the Russian Ambassador by her courts in violation of the most ancient of international rules; and although Parliament was promptly called on to adopt the rule of extraterritoriality, and humble apologies were made, the breach between the two governments because of the scandal was long continued.

Between our Republic and France very serious discussions have arisen during the century, but none which have been beyond the power of diplomacy to adjust. Once indeed (1880) the intervention of a friendly power was agreed upon merely for the appointment of a third commissioner upon a board for the adjustment of claims. There are no boundary questions between the two dominions, separated by an ocean, and no probable disputes except those which may arise upon the interpretation of

international laws or treaties, or for damages to neutral interests in war. It is therefore with pleasure that we recall the unanimous passage by the House of Deputies of the French Parliament, on the 8th of July, 1895, of the following resolution:

"Le Chambre invite le gouvernement à négocier le plus tôt possible la conclusion d'un traité d'arbitrage permanent entre la Republique Française et la Republique des Etats-Unis d'Amérique."

A previous resolution of like tenor had been approved by all the Bureaux of the Chamber in 1888, but not forwarded to a vote. We are justified, therefore, in assuming that French opinion has reached a point as advanced as our own in favor of permanent provisions for arbitration between these two countries, each of which would revolt at the thought of sundering their ancient and long unbroken friendship.

In regard to the line which separates the questions which may be submitted to arbitration from those which nations must reserve for their own independent decision, the determination must be left to those experienced men who have reached the third degree in international diplomacy. That there are questions of national honor and safety which no self-respecting government will agree in advance to submit to the final decision of a third party, I fully admit. The utmost that can be expected in such cases is an agreement to have recourse to the friendly mediation of a third power, before a resort to hostilities. This proceeding would in most instances be effective in bringing both to an understanding.

From our point of view these two groups of nations can at any time proceed to the negotiation of a treaty providing for the reference to arbitration of all differences hereafter arising between them, which shall not be adjusted through ordinary diplomatic agencies, and so far as they fall within the classification which should be set forth in a special article. They would of course provide for the observance by each in good faith of the decision of the arbitrators. For example, the following classification might be offered as a basis: (*a*) Conflicting claims of territorial boundary lines or jurisdiction. (*b*) Conflicting claims of marine jurisdiction, or touching the rights or exemptions of vessels, persons or property on the high seas or in the ports or waters of either nation, whether arising under international law or

treaty. (*c*) All claims for damages made by one government against the other on account of wrongs done to the citizens or subjects of either within the jurisdiction of the other, or to the property of either government, or of its citizens or subjects, in respect to which the government is responsible, or alleged to be responsible. (*d*) All disputes of law or fact arising under the provisions of any treaty then in force between the two nations. (*e*) Differences arising between them in respect to a refusal or violation of diplomatic or consular rights and privileges, alleged by one government against the other. The arbitral tribunal to decide the extent of its conferred jurisdiction.

It is greatly to be desired that a clause should be also agreed to, providing that in all other cases whatever there should be a resort to the mediation of a friendly power or powers before having recourse to hostilities. This alone would be an inestimable contribution to the cause of peace. This space for reflection, this time for the cooling of temper on the part of both ministers and people, this invited intervention of an impartial third party, would in most cases open the road to reconciliation. Even on questions of national honor and dignity an offending or offended government could afford to accept as the award of a court of honor what it could not itself propose. This yielding to the advice of a third and friendly power, instead of to the demands of an ungracious adversary, often saves the points of both honor and safety to the yielding government.

In respect to the differences so subjected to arbitration, they should renounce the right of war against the party conforming to the rule of arbitration, each party retaining the right to enforce the arbitral decrees. Another article would provide for the organization of the court of arbitration. A third might extend the agreement to include all other differences which do not in the judgment of either government involve its safety or its honor.

An international convention embracing these provisions would notably inaugurate that era of peace for which the overburdened nationalities of the Christian civilization have been waiting. There are some groups of nations which will not yet accept it. But so far as concerns the two groups under consideration, there is no serious obstacle in the way of either nation proceeding now by a special commission, or otherwise, to settle the terms of such a convention.

Compulsory Mediation.

The proposed provision for mediation in all cases before an act of hostility is not new to diplomacy. It has already been once provided for in a general treaty now in force. In the Congo Conference, held in Berlin in 1884-5, I proposed in behalf of the United States the acceptance by the fourteen powers assembled in that Conference of the principle of arbitration for all differences which might arise between them in respect to their Central African possessions. This proposition obtained the adhesion of nearly all the powers, including the very active support of Germany and Italy. France stood resolutely against it. Its prolonged discussion finally resulted in a compromise article (the twelfth of the treaty) which was as far as the French plenipotentiary was willing to go. This article provides that where serious differences between the signatory Powers shall arise on the subject or within the limits of these territories, the Powers involved shall resort to the mediation of one or more friendly governments before appealing to arms. They reserve to themselves as an alternative the option of arbitration. This result—compulsory mediation, optional arbitration—was a great gain to the principles of peace. It is a remarkable fact that Mohammedan Turkey accepted arbitration for Africa, while Christian France and Portugal at that time repudiated it.

During this generation, at least, no powerful nation will bind itself to arbitration much beyond the limitations which have been here generally indicated. For unknown questions, for some unknown conditions of the future, the dreadful right of war will be, and for the present ought to be, retained for the security of that independence, liberty and civilization which have so largely owed to it their modern progress and security. We shall still look to the polished points of our bayonets to reflect on us the desired sunshine of Peace.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

NAVAL LAW AND NAVAL COURTS.*

By Charles H. Lauchheimer, First Lieutenant, U. S. Marine Corps.

Gentlemen:—The subject assigned me by the President of this College—Naval Law and Naval Courts—is one of such magnitude that it has been quite a task to condense into two lectures such features as I trust will be not only interesting but at the same time instructive to the student of that branch of our profession which, I regret to state, has hitherto been neglected and not given that degree of attention which its importance merits. A knowledge of naval law is, in my humble opinion, necessary to the naval officer who desires properly to perform the functions of his office, no matter what his rank or position may be. I have designed to preface my remarks with a brief history of naval law, and then to discuss the various tribunals which by statute are in force in the naval service, and which are known as Naval Courts.

Naval Law.

Naval law is synonymous with military law, and in its restricted sense is the specific law governing the Navy as a separate community. Ordinarily and for all practical purposes military and naval law may be considered under the general head of military law, and hereafter in these lectures whenever the term military law is used, it is to be understood as including naval law, *i. e.*, I will speak of that branch of the law which governs the Army, Navy, and the Militia when called into active service, but with special reference, however, to that branch thereof which pertains to the naval service.

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At the very beginning may I ask your attention to the distinction between military and martial law, the latter being operative only in time of war or like emergency when the military government supersedes the civil, and has as its object the control of the respective armies and of those violating, in respect to said armies, the laws of war; whilst military law, as before stated, is the specific law governing the Army and Navy, in time of peace as well as war.

Historically considered, military law antedates the Constitution, but as, however, all law, both public and private, began to exist or operate anew from the time of this instrument, it is customary to designate the Constitution as the source of all military law. We have, therefore, only to look at that document to find the specific provisions which may be regarded as the source or sanction of our present military law and its jurisdiction, and they are as follows:

Congress is empowered "to define and punish offenses against the law of nations;" "to declare war, grant letters of marque and reprisal and make rules concerning captures on land and water;" "to raise and support armies;" "to provide and maintain a navy;" "to make rules for the government and regulation of land and naval forces;" "to provide for calling forth the militia to execute the laws of the Union, suppress insurrections and repel invasions;" "to provide for organizing, arming and disciplining the militia, and for governing such part of them as may be employed in the service of the United States;" and generally "to make all laws which shall be necessary and proper for carrying into execution the foregoing powers" (*i. e.*, those set forth as well as others in the same section), "and all other powers vested by this Constitution in the Government of the United States or in any department or officer thereof." The President, as Commander-in-Chief of the Army and Navy of the United States and of the militia of the several States when called into actual service of the United States, is empowered to appoint (in conjunction with the Senate) and to commission the officers of the Army and Navy, etc., and it is also made his duty "to take care that the laws be faithfully executed."

And perhaps the most important of all, the Fifth Amendment, which provides that "No person shall be held to answer for a

capital or otherwise infamous crime unless on a presentment or indictment of a Grand Jury, except in cases arising in the land or naval forces, or in the militia when in actual service in time of war or public danger."

Military law, which as I have before stated, is operative both in peace and in war, is both written and unwritten, just as is the civil law.

The written military law, so far as it applies to the Navy, is founded upon the statutory code known as the Articles for the Government of the Navy; other statutory provisions relating to the Navy; the Navy Regulations, and general and special orders issued by the Department.

The unwritten military law, while it has derived from the common law certain of its precepts and doctrines, has nevertheless an unwritten law distinctively its own, which consists of certain established principles and usages peculiar or pertaining to the naval service, and which, from their immemorial usage, are as well known to the officers of the service as are the doctrines of the common law to the lawyer. The customs of the service are recognized as binding on courts-martial, and in fact, by the act entitled "An act for the government of the Navy of the United States," approved March 2, 1799, it is provided that "every commander-in-chief and captain, in making private rules and regulations, and designating the duties of his officers, shall keep in mind also the customs and usage of the sea service most common to our nation." This, in effect, provides a statutory enactment for the recognition of the unwritten military law.

In our service the unwritten military law is very meagre, for from time to time the customs of the service have been embodied in the Navy Regulations, and have thus become part of the written military law. Still there does exist an unwritten military law, and perhaps it will not be out of place to state here that in order that a particular usage or custom may have the force of unwritten law, it must fulfill certain conditions, the most important of which are that it must be uniform, well defined, and equitable; must be of long standing; must be certain and reasonable, and not in conflict with statute or constitutional provisions, and must be so long continued and notorious that all persons concerned may be presumed to have knowledge of it.

It must also refer to a subject upon which the written law is silent, and must not be prejudicial to discipline. It is essential that all these conditions be present in order that the custom or usage may come within the category of the unwritten law.

Naval law, therefore, as we find it, is principally statutory law, or regulations made in conformity therewith, and the customs of the service.

With this short review of what naval law is, we will pass to the consideration of those tribunals by which it is administered, *i. e.*, courts-martial and courts of inquiry, and will first trace briefly the origin and history, the nature as a legal tribunal, the constitution, the composition and jurisdiction of courts-martial.

Origin and History.

Some form of tribunal for the trial of military offenses seems to have existed since the early history of armed forces. In Rome, justice was administered by the *Magistri militum*, and especially by legionary tribunes either as sole judges or with the assistance of councils. Among the early Germans, in times of peace the courts were held by the counts, assisted by the freemen, but in time of war by the duke or military chief, who generally delegated this authority to the priests who accompanied the army; later, courts of regiments were formed, and the matter was left to the colonel of the regiment, who could, however, delegate his authority to an officer by investing him with the staff or mace called the *regiment* as the emblem of judicial authority. Courts-martial proper (Militär-gerichte), however, probably date from the Articles of War promulgated in the time of Frederick III, 1487; they (the courts) were specifically provided for in the penal code of Charles V, although more accurately defined in the articles of Maximilian II, of 1570. In France, courts-martial (conseils de guerre) were first established by the ordinance of 1655. Previous to this, military prisoners were subjected to the jurisdiction, successively of the Mayor of the Palace, the Grand Seneschal, the Constable, and the Provost-Marshal. In England, the original of the modern court-martial is seen in the "King's Court of Chivalry," or as it was also called, the "Court of Arms" or the "Court of Honor," of which the judges were the Lord High Constable and the Earl Marshal. These officials also formed part of the "Aula Regis"

of William the Conqueror, but it was not until the subdivision of that tribunal into separate courts by Edward I, in the latter part of the 13th century, that the Court of Chivalry had an independent existence; as thus constituted its jurisdiction was an extended one, applying to matters both civil and criminal, and touching "all matters of honor and arms," "pleas of life and member arising in matters of arms and deeds of war," "the rights of prisoners taken in war," and also to "offenses and miscarriages of soldiers contrary to the rules of the army" and to "civil crimes and matters of contract." Owing to the extended jurisdiction accorded to this tribunal, it gradually encroached upon the common law courts and consequently it was, by various acts of parliament, gradually shorn of much of its power, and although never specifically abolished by statute, it had, nevertheless, before the English Revolution, practically ceased as a military tribunal. Subsequent to the decadence of the Court of Chivalry and preceding the first mutiny act, justice was administered by martial courts, or councils, convened in accordance with the articles of war then in force. During the reign of the Tudors and Stuarts and prior to the Petition of Right, military law, as administered, resembled martial law rather than military law of modern times, as civilians were tried by courts-martial and even the death penalty inflicted upon them in cases where the law of the land did not authorize such jurisdiction or punishment. Finally, by the mutiny act of 1689, the death penalty was prohibited except in certain cases and the Sovereign (for the first time by legislative authority) was expressly empowered to grant commissions to convene courts-martial, and this authority was gradually increased and enlarged by subsequent mutiny acts and Articles of War, and finally established and defined by the Army Act of 1881.

The English military tribunal having been transplanted to this country prior to our Revolutionary War, was recognized and adopted for the army by the Continenal Congress in the Articles of War of 1775, in which the different kinds of courts were distinguished and their composition and jurisdiction defined. These articles were amended by those of 1776 and 1786. The first act of the Continental Congress tending to the establishment of rules and orders for the Navy of the United Colonies was passed November 24, 1775. This was subsequently

modified from time to time, and finally enacted into the first act for the better government of the Navy of the United States, approved April 23, 1800. Since then articles have, from time to time, been enacted, those referring to the Army being known as the "Articles of War," and those referring to the Navy as "Articles for the Government of the Navy." The articles under which naval courts now derive their power and jurisdiction are contained in the act approved July 17, 1862, and known as Section 1624 of the Revised Statutes.

Nature of the Court-Martial as a Legal Tribunal.

By Article 1, Section 8, of the Constitution, Congress is empowered "to make rules for the government and regulation of the land and naval forces," and in pursuance of this authority it has enacted "Articles for the Government of the Navy," which contain provisions relating to the organization, jurisdiction, and other features of naval courts-martial. The Fifth Amendment, before referred to, is also frequently considered as the source of authority for courts-martial, for, as stated by Attorney General Cushing (6th Opin., 425), this amendment "expressly excepts the trial of cases arising in the land or naval service from the ordinary provisions of law," and, as was decided in the case of Trask vs. Payne, (43 Barb., 569) "this provision practically withdraws the entire category of military offenses from the cognizance of the civil magistrate, and turns over the whole subject to be dealt with by the military tribunals." This decision has only recently been confirmed by the Supreme Court in the naval case of Johnson vs. Sayre (158 U. S., 109).

Another authority for the creation of courts-martial is attached to the constitutional function of the President as commander-in-chief of the army and navy.

Courts-martial of the United States have a legal sanction of equal importance with the federal courts; still, unlike the latter, they are not a portion of the judiciary of the United States, and are not, therefore, included among the "inferior courts" which Congress "may from time to time ordain and establish." In the leading case of Dynes vs. Hoover (20 Howard, 79), the Supreme Court held, referring to the provisions of the Constitution before referred to, that "these provisions show that Congress has the power to provide for the trial and punishment of military and

naval offenses in the manner then and now practiced by civilized nations, and that the power to do so is given without any connection between it and the 3d article of the Constitution defining the judicial power of the United States; indeed, that the two powers are entirely independent of each other." Again, in *Ex parte* Vallandigham (1 Wallace, 253), the court held the authority exercisable by a military commission though "it involves discretion to examine, to decide and sentence, is not judicial in the sense in which judicial power is granted to the courts of the United States." From this it appears that courts-martial, not belonging to the judicial branch of the Government, must pertain to the executive branch, and they are, in fact, *instrumentalities of the executive*, provided by Congress in order to enable him, as Commander-in-Chief, properly to command the Army and Navy and enforce discipline therein, and utilized under his orders or those of his authorized military representatives. Being a purely executive agency, which is designed for military uses, called into existence by a military order and, when its work is completed, dissolved by a similar order, it follows that the court-martial, as compared with a civil tribunal, is transient in its duration, and summary in its action; for, as stated by the Supreme Court in *Ex parte* Milligan (4 Wallace, 123), "the discipline necessary to the efficiency of the Army and Navy required other and swifter modes of trial than are furnished by the common law courts."

And, as stated by Colonel Winthrop, courts-martial, unlike the superior courts of record, have no fixed places of session, no permanent office or clerk, no inherent authority to punish for contempt, no power to issue a writ or judicial mandate, and their judgment is simply a recommendation, not operative until approved by a revising power. It consequently belongs to the class of minor courts of special and limited jurisdiction and scope, where competency cannot be extended by implication, in favor of whose acts no intendment can be made when their legality does not clearly appear, and which cannot transcend their authority without rendering their members trespassers and amenable to civil action.

Furthermore, as the court-martial is no part of the judiciary of the country, its proceedings are not subject to be directly reviewed by a Federal Court either by *certiorari*, *writ of error*, or

otherwise, nor are its judgments or sentences subject to be appealed from to such tribunal. It is not only the highest but the only court by which a military offense can be heard and determined, and a civil or criminal court has no more appellate jurisdiction over offenses tried by court-martial—no more authority to entertain a rehearing of a case tried by it, or to affirm or revise its finding or sentence as such—than have the courts of a foreign nation.

In the case of Dynes vs. Hoover, above cited, the court held that the duly confirmed sentence of a court-martial "is altogether beyond the jurisdiction or inquiry of any civil tribunal whatever," and that with reference to the legal sentence of competent courts-martial "civil courts have nothing to do, nor are they in any way alterable by them," for "if it were otherwise the civil courts would virtually administer the rules and articles of war irrespective of those to whom that duty and obligation have been confided by the laws of the United States, from whose decisions no appeal or jurisdiction of any kind has been given to the civil magistrate or civil courts."

In the case of Wales vs. Whitney (114 U. S., 564), which was a proceeding instituted against the Secretary of the Navy for the discharge on *habeas corpus* of Medical Director Wales, the Supreme Court held that "no Federal Tribunal has any appellate jurisdiction over the naval court-martial, nor over offenses which such a court has power to try," and also that no such tribunal "is authorized to interfere with a court-martial in the performance of its duty by way of a writ of prohibition or any order of that nature."

The writ of prohibition above referred to is resorted to to prevent the doing of an act not yet performed or completed, and has never been granted in a military case in this country, nor had one been applied for in any case pending before a naval or military court-martial before the case of Paymaster General Smith of the Navy, in which, in view of the ruling of the Supreme Court in the case of Wales vs. Whitney, above referred to, the writ was refused by the Supreme Court of the District of Columbia, September 25, 1885. The decision of the Supreme Court of the District of Columbia was subsequently affirmed by the Supreme Court of the United States (116 U. S., 167).

The appeal from courts-martial is vested in the President or

Secretary of the Navy, the latter being assisted and advised by the Judge Advocate General of the Navy.

Although, as above stated, the civil courts have no right of entertaining an appeal from courts-martial, yet the writ of *habeas corpus* may be awarded to a prisoner claiming to be illegally detained under trial or sentence of court-martial, and in this proceeding the legality of the action of the court, *i. e.*, whether it was legally constituted, whether it had jurisdiction, and whether the sentence is one it was authorized to inflict, may be inquired into, but the action must have been absolutely illegal and void in law, before the federal courts will grant relief, for, as held by the Supreme Court in *Ex parte* Mason (105 U. S., 697), it, the Supreme Court, "has no power to review the judgment of courts-martial" and that it cannot, upon *habeas corpus*, discharge a person under sentence of court-martial, "if the court had jurisdiction to try the offender for the offense with which he was charged, and the sentence was one which the court could, under the law, pronounce." In *Ex parte* Reed (100 U. S., 23) the Supreme Court held that "a writ of *habeas corpus* cannot be made to perform the function of a writ of error. To warrant the discharge of a petitioner, the sentence under which he is held must be not only erroneous and voidable, but absolutely void." In Wales vs. Whitney (114 U. S., 575), it is held that even when the court-martial had in fact no jurisdiction, the power of the civil tribunal on *habeas corpus* "extends no further than to release the prisoner. It cannot remit a fine, or restore to an office, or revise the judgment of the military court." It was further held in this case that when the officer's arrest simply confined him to the limits of the city of Washington it was not such physical restraint as to be a subject of discharge on *habeas corpus*.

Inasmuch as there is no appeal to the civil courts, the judgment of a court-martial is, within its scope, absolutely final and conclusive. Its sentence, if *per se* legal, after it has received the necessary official approval, cannot be revoked or set aside, and it is only by the exercise of the pardoning power that it can, if not as yet executed, be rendered in whole or in part inoperative.

Although, as above stated, the court-martial is but an instrumentality of the executive power, having no connection with the judiciary, it is, nevertheless, within its field of action, as fully a court of law and justice as is any civil tribunal. As a

court of law it is bound, like any other court, by the fundamental principles of law, and in the absence of a special provision it is to be governed in the matter of evidence by the rules of the common law courts. As a court of justice it is to decide between the United States and the accused, according to the evidence, the rules for the government of the Navy, and its own conscience.

The old-time designation of the court-martial as a "court of honor," although not often used, is still as applicable as it was formerly, because a court-martial punishes dishonorable conduct when it affects the reputation or discipline of the Navy; as, for example, a court-martial can try an officer for "conduct unbecoming an officer and a gentleman," which is an offense not cognizable in any other court of the land; and even though it does proceed on the ground of being a court of honor, it is, nevertheless, bound in its procedure by the rules of criminal pleading and evidence.

One of the greatest distinctive peculiarities of a court-martial is its dual function of judge and jury; for in its capacity of jury it takes the oath, is liable to be challenged, hears and weighs the evidence, finds the accused guilty or innocent, and is liable to be recalled to revise its proceedings; in its capacity of judge it arraigns the accused, hears and determines questions as to its own jurisdiction, hears and decides upon the competency of pleadings and testimony, sentences the accused, and finally adjourns.

In the case of the United States vs. Clarke (96 U. S., 40) the Supreme Court held that a court-martial is strictly a criminal court, and in fact it has no civil jurisdiction whatsoever; *i. e.*, it cannot enforce a contract, collect a debt, award damage from one to another, for all the fines which it does award inure to the Government.

Constitution of General Courts-Martial.

The authority to constitute general courts-martial is found in Article 38 of the Articles for the Government of the Navy, which provides—

> General courts-martial may be convened by the President, the Secretary of the Navy, or the commander-in-chief of a fleet or squadron; but no commander of a fleet or squadron in the waters of the United States shall convene such court without express authority from the President.

This article plainly designates the persons authorized to convene courts-martial, and in conformity with the concluding paragraph, it is the custom of the Navy Department to request of the President, whenever an officer is ordered to command the North Atlantic or Pacific Stations, that authority be granted him to convene general courts-martial when in the waters of the United States, and this request is invariably granted.

Composition of General Courts-Martial.

The law which refers to the composition of general courts-martial is found in Article 39 of the Articles for the Government of the Navy, which provides—

> A general court-martial shall consist of not more than thirteen nor less than five commissioned officers as members; and as many officers, not exceeding thirteen, as can be convened without injury to the service, shall be summoned on every such court. But in no case, where it can be avoided without injury to the service, shall more than one-half, exclusive of the President, be junior to the officer to be tried. The senior officer shall always preside and the others shall take place according to their rank.

From this it will be seen that only commissioned officers are eligible to membership of general courts-martial, the detailing of a warrant officer, cadet, petty or non-commissioned officer when the person to be tried is one of such grades, which, although authorized in European codes, has never been authorized by our law.

The only class of commissioned officers in time of peace who are exempt from this duty are retired officers who, by Section 1462 of the Revised Statutes, are not to be employed on active duty except in time of war.

The question is often asked, who are commissioned officers? and the answer is, all those who have duly received and accepted commissions appointing them to offices in the Navy. They are as much commissioned officers when they have temporary as permanent commissions. By a temporary commission I mean those which by the Constitution, the President is empowered to confer during a recess of the Senate to "expire at the end of the next session."

The question of the relative rank of members is an important one, and with a view of excluding, as far as practicable, officers

who are junior to the accused it is provided that "no officer shall, when it can be avoided, be tried by officers inferior in rank," but this provision is simply directory and it is a matter entirely within the discretion of the convening authority to decide upon not only the number of officers to constitute the court, but also the rank of its members; but as a general thing, if it can be avoided, juniors should not be placed on courts to try seniors. To show that the convening authority has had in view the provision of the law just referred to, the precept should invariably state that "no other officers can be summoned without injury to the service." Objections are often made because at least a majority of the court are not senior to the accused, and as a rule the court invariably and rightly fails to sustain such objection. The Attorney General has repeatedly decided that in no case is such an objection valid, as the discretionary power of the convening authority should in no case be abridged.

Officers of one branch of the service, as the Army, are not eligible to sit as members of a court to try offenders of the Navy, and *vice versa*, the only exception being in the case of Marine officers who, when detailed by order of the President for service with the Army may be associated with officers of that service for the trial of offenders in the Army, and *vice versa*. Under similar circumstances Army officers may be detailed as members of courts to try offenders in the Marine Corps, and it may even be that in such a case the court may be composed wholly of Army or Marine officers, for the trial of persons of the Marine Corps or Army respectively.

In the case of courts-martial in the militia of the several States when called into active service, Section 1658 of the Revised Statutes provides that "courts-martial for the trial of militia shall be composed of militia officers only." The proceedings of those courts are not reviewable by the civil courts. There is no similar provision of law with regard to the naval militia recently organized, still by inference, and until there be some express provision of the law, it would follow that they should also be tried only by their own officers, that is, by a court composed of officers not necessarily of the same State, but by officers of the militia of any of the States.

Number of Members.

Article 39 of the Articles for the Government of the Navy provides *inter alia* that—

> A general court-martial shall consist of not more than thirteen nor less than five commissioned officers as members; and as many officers, not exceeding thirteen, as can be convened without injury to the service shall be summoned on every such court . . .

From this it is seen that the number of members is to be not more than thirteen nor less than five, and that at least the latter number is necessary to constitute a quorum for trial and judgment. Although five is all that is necessary, yet it is customary to detail at least seven members on a court so that there will be a working quorum in case of illness or absence of any member. When but five officers are ordered as members of a court the other four may deliberate on the challenge of a member, and if it is sustained may meet and adjourn until the convening authority is heard from. In the same manner when at the outset a member is absent by reason of illness or for any other cause, the other four may meet and adjourn, but at least five must be present and sworn to constitute a court for the trial, and at least five must be present during the entire trial.

When there are more than five members originally, the absence of one or more members does not affect its competency to proceed so long as five remain. As a familiar illustration,—a court which consisted of thirteen members may be reconvened for a revision of the sentence, and five members may so reconvene, revise the sentence, and the revised sentence is the sentence of the court. As before stated, the number—within the limits of the law—to be detailed on a general court-martial is a matter of discretion with the convening authority, and from his decision there is no appeal. This point was decided by the Supreme Court in 1827, in the case of Martin vs. Nutt.

When a general court-martial is reduced below five members it need not necessarily be dissolved, but additional members may be detailed, and when they have been sworn and taken their seats its power as a court is restored, and it may legally proceed with the trial, but the accused is, of course, entitled to challenge, and the new member or members to have all the proceedings read over to them, the testimony of the witnesses to be read in

the presence of the witnesses, and the new member or members to ask such questions as they may desire; in fine, the entire proceedings are gone over again for the benefit of the new members in order that they may be perfectly *en rapport* with them.

Jurisdiction of General Courts-Martial.

In considering the question of the jurisdiction of general courts-martial we will divide the subject into four heads:

1. The place over which such jurisdiction extends or within which it may be exercised.
2. The period of time to which its exercise is limited.
3. The persons who are subject to it.
4. The offenses which it embraces.

(1) The jurisdiction of general courts-martial is co-extensive with the territory of the United States, so that no matter in what part of the United States the offense was committed, a general court-martial has jurisdiction, and in this respect it will be noted that it is different from civil courts whose jurisdiction is limited to offenses committed within certain prescribed limits of territory. Vessels of war having the right of exterritoriality, no matter where they are, they are part of the United States for this purpose. It may be well to state here that a general court-martial must never, in time of peace, be convened on foreign territory, for, if so, the proceedings are absolutely void *ab initio*. In the case of *Ex parte* Milligan (4 Wallace, 141), the Supreme Court held that "wherever our Army or Navy may go beyond our territorial boundaries, neither can go beyond the authority of the President or the legislation of Congress." This jurisdiction extends to offenses committed by persons in the naval service when in occupation of insurrectionary districts, and it has been held that during the late war under such circumstances our Army was exempt from amenability to the local courts, and subject only to its own military tribunals. Both in times of peace and war, the jurisdiction of general courts-martial extends to offenses committed on shore by persons who are within the jurisdiction of the court.

In case of permission being granted by a foreign power, with which we are at peace, for our naval force to march across its territory, the jurisdiction of a general court-martial extends to offenses committed by officers and men within the lines or within

the neighborhood of the forces. This is based on the principle of exterritoriality under which, when the armies or navies of one nation are privileged to enter or pass through the country of another friendly nation, the laws of the former are deemed to continue to apply to its forces equally as if the same were within their own country. An illustration is afforded in the legal status of our army when permitted by Mexico to cross its territory in carrying on hostilities with the Indians.

In cases where an armed force of the Navy is induced to enter a foreign power's dominion with whom we are at peace and without its authority, the question as to the jurisdiction of a general court-martial is rather an unsettled one, but most of the authorities are of the opinion that it should have jurisdiction over naval offenses committed by any of its number on the foreign soil, provided the offender was, at the time the offense was committed, a member of an organized detachment under military command and discipline. But when the offender, even though in the service, is not on the foreign soil in his official capacity, as when he is there as a deserter, he would not be within the jurisdiction of a general court-martial. A case which covers this point is one in which an officer of volunteers was tried and dismissed the Army "for violation of the sovereignty of a friendly state, in arresting a deserter from the United States forces and bringing him away from within the boundaries of Canada."

(2) The question of the time within which a naval general court-martial has jurisdiction has recently been defined by the act of Congress approved February 25, 1895, and now known as Articles 61 and 62 of the Articles for the Government of the Navy, and which provide as follows:

ARTICLE 61. No person shall be tried by court-martial or otherwise punished for any offense, except as provided in the following article, which appears to have been committed more than two years before the issuing of the order for such trial or punishment, unless by reason of having absented himself, or of some other manifest impediment, he shall not have been amenable to justice within that period.

ARTICLE 62. No person shall be tried by court-martial or otherwise punished for desertion in time of peace committed more than two years before the issuing of the order for such trial or punishment, unless he shall meanwhile have absented himself from the United States, or by reason of some other manifest impediment shall not have been amenable to justice within that period, in which case the time of his absence shall

be excluded in computing the period of the limitation; *Provided*, that said limitation shall not begin until the end of the term for which said person was enlisted in the service.

The 103d Article of War in the Army is similar to Article 61, first above quoted, and has been in force for years. It was at one time questioned whether the provision was a prohibitory restriction upon jurisdiction, or merely as providing a defense to be taken advantage of by special plea. In 1820 Attorney General Wirt held in construing the 103d Article that the limitation prescribed by the article was *absolute* and could not be *waived;* he based his decision on the ground of public policy, being intended not solely for the benefit of the accused, but to secure that prompt and certain prosecution of military offenses which is essential to maintain the discipline of the service and that, therefore, it was to be regarded as prohibitory not only upon the United States but also upon the accused.

This opinion of Mr. Wirt has been affirmed by subsequent Attorneys General and has been strictly enforced in the Army as a rule of law to which no exceptions could be admitted. Even in the case where the accused requested to waive the restriction, the Judge Advocate General of the Army, and subsequently the Attorney General, held that it could not be done. The question has never arisen in our service, but the opinion of the Attorney General just cited would be applicable to a case in the naval service.

It may be proper to state that cases are cited in which the civil courts have, in effect, though not in terms, overruled the opinions of the Attorney General and directed that the statute of limitation of the military service, like those of the civil courts, shall act not as a restriction upon the court, but as a provision solely for the benefit of the accused of which he can take advantage by plea. It will be noted that the 62d Article makes an exception of the offense of *desertion*, which all authorities agree is a continuing offense, and as such that the statute does not begin to run until the termination of the term of enlistment; thus a man enlisting for three years, who deserts the third day of his enlistment, will be amenable to trial for a period of five years,—to wit, two years from the date of the expiration of the enlistment during which he deserted.

When an offense is by express provision of statute, or by

implication of its terms, restricted to a period of war, the jurisdiction of a general court-martial is similarly restricted, as for example, Section 1624 of the Revised Statutes, Article 5, being the Articles for the Government of the Navy, provides as follows:

> All persons who, in time of war, or of rebellion against the supreme authority of the United States, come or are found in the capacity of spies, or who bring or deliver any seducing letter or message from an enemy or rebel, or endeavor to corrupt any person in the Navy to betray his trust, shall suffer death, or such other punishment as a court-martial may adjudge.

This refers to the offense of the spy, and inferentially limits the trial by court-martial of a spy to the period of the duration of the war, so that if he is not brought to trial before the war is terminated, he cannot be tried at all. This rule was laid down *In re* Martin (45 Bart., 142, N. Y.). By the term "war" is meant not only foreign or international war, but also civil war, as well as a state of active hostilities, as with an Indian tribe. In considering this phase of the subject it may be well to define when war begins and ends. An international war will generally commence to exist upon a declaration of the same in some form by Congress under the clause of the Constitution which empowers that branch of the Government "to declare war." But such a declaration is not absolutely essential, as in case our country should be invaded by a foreign foe and before Congress could be assembled, then the Executive, as Commander-in-Chief, can call forth the troops to check the invasion, and this armed meeting and resistance would constitute the commencement of "war." In case of an insurrection or rebellion the commencement of war dates from the time when it has assumed such proportions that it becomes necessary to employ the armed forces of the United States to combat and suppress it. This action is promulgated in the form of a *proclamation* or order issued by the President.

The Constitution vests the authority to make treaties in the President, "by and with the advice of the Senate," and this practically gives to him the peace-making power so far as relates to a foreign war, so that in such a case the war ends with the date of the treaty or other agreement for the cessation of hostilities, and the date is announced by executive proclama-

tion. In case of *civil war*, a proclamation by the President announcing that the rebellion has been suppressed may be accepted as the authoritative date of the cessation of the state of war, and between these dates a status of war exists so far as the jurisdiction of courts-martial is concerned.

(3) With reference to the persons subject to the jurisdiction of general courts-martial, it may be stated that as the courts themselves owe their existence to statutory provision, they can exercise jurisdiction over such persons and offenses only as are constitutionally brought by statute within their cognizance, and these may be defined as follows:

The Navy of the United States, including the Marine Corps;

Certain civilians subject to naval discipline in time of war; and

The naval militia when called into service of the United States.

As especially applicable to the officers and men of the regular service, it may be well to state that, as to the period of their amenability, it is a well founded rule that it exists only during the period of service as an officer or enlisted man; *i. e.*, in the case of an officer his amenability commences from the acceptance of his commission and ends with his death, the acceptance of his resignation, or his dismissal. The same is true so far as enlisted men are concerned. In other words, so long as they are military persons they are subject to military jurisdiction.

There are a few exceptions to this rule when applied to enlisted men, and they are as follows:

(*a*). In case of desertion, which is a continuing offense, and as such continues up to the date of the expiration of the enlistment and from that date the statute of two years limitation begins to run.

(*b*). In case of an illegal enlistment which is voidable, if after enlistment the person so enlisted deserts, he may upon arrest be held, tried, and punished for his offense.

(*c*). As a general rule it has been laid down that if the military jurisdiction has once duly attached to military offenders prior to the date of the termination of their legal period of service they may be brought to trial by court-martial after that date, their discharge being meanwhile withheld. This generally applies to offenses committed the last day of the enlistment. A leading case in this respect is that of *In re* Walker, in which the Supreme Court of Massachusetts, in the case of a sailor in the

Navy, in adverting to the injurious results that might ensue were such a person permitted to plead guilty with impunity to grave offenses on the last day of his service, adds, "It is true that a seaman is not bound to do service after the expiration of his term of enlistment. But within that term he is bound to observe the rules and regulations prescribed by law for the government of the Navy, and is punishable for all crimes and offenses committed in violation of them during this term of service." In this case the petitioner was arrested or put in confinement and charges were preferred against him by the Secretary of the Navy before the expiration of his term of enlistment, and this was clearly a sufficient commencement of the prosecution to authorize a court-martial to proceed to trial and sentence, notwithstanding that the term of service had expired before the court-martial had been convened.

An exception to the question of amenability to trial by court-martial arises in the case of an officer or enlisted man who, although in the service, is duly absent from his station by leave of absence or furlough. It is apparent that these persons, during such time, cannot be guilty of a breach of discipline, neglect of duty or disobedience of orders (except one given in time of exigency to discontinue his leave), so if during such leave or furlough he commits an offense he will be amenable therefor to the civil tribunals without prior application to the military authorities. Of course, during leave of absence or furlough they can be tried by court-martial for "conduct unbecoming an officer and gentleman," "desertion," or any conduct tending to cast dishonor upon the service.

A prisoner of war in the hands of the enemy is also exempt, but of course can be tried for grossly contumacious language or injurious conduct towards another officer in the same situation.

Again, exceptions to the general rule that military jurisdiction terminates with discharge are those which are expressly provided for by statute as in the case of Articles 37 and 14, Section 1624 of the Revised Statutes, which provide—

ARTICLE 37. When any officer, dismissed by order of the President since 3d March, 1865, makes, in writing, an application for trial, setting forth, under oath, that he has been wrongfully dismissed, the President shall, as soon as the necessities of the service may permit, convene a court-martial to try such officer on the charges on which he shall have

been dismissed. And if such court-martial shall not be so convened within six months from the presentation of such application for trial, or if such court, being convened, shall not award dismissal or death as the punishment of such officer, the order of dismissal by the President shall be void.

The provisions of this article originally enacted during a period of war are applicable only to cases arising during war.

ARTICLE 14. If any person, being guilty of any of the offenses described in this article, while in the naval service, receives his discharge, or is dismissed from the service, he shall continue to be liable to be arrested and held for trial and sentence by a court-martial in the same manner, and to the same extent, as if he had not received such discharge or been dismissed.

In the Army there is express legislation contained in Sections 1361 and 2824 of the Revised Statutes, which makes amenable to trial and punishment by court-martial, under the rules and Articles of War, all prisoners under confinement in military prisons for offenses committed during said confinement, and also all persons admitted into the Soldiers' Home, who are subject to the Articles of War in the same manner as soldiers in the Army.

There is no express legislation on this point required in the Navy, as in our service prisoners are, whilst in confinement, still in the service, and, therefore, amenable in the same manner as though on active duty, and doubtless this rule would apply to inmates of the Naval Home, although I know of no case on record where an inmate of the Home has been tried by court-martial, as the Department dismisses from that institution all those who show by their conduct that they are unworthy of the benefits which the Home gives them.

The question of the amenability to trial of an officer or man (when duly dismissed, resigned, or discharged) for an offense committed prior to such discharge (and within two years) but not yet made the subject of charge or trial (except those just referred to) is a mooted one, and there appears to have been no adjudication on this point; but I believe the consensus of authority is to the effect that a subsequent reappointment or re-enlistment would not renew the jurisdiction for past offenses, but the same would be properly considered as finally lapsed.

The question is often asked whether an officer or enlisted man can at the same time be subject to the jurisdiction of a civil

tribunal and a court-martial for the same offense, and the answer is invariably in the affirmative, as has been decided by the courts in numerous adjudicated cases. Of course the civil and military courts take cognizance of different phases of the offense. Thus, an officer who has been tried and found guilty of larceny on shore, and sentenced to imprisonment, may properly be tried for conduct unbecoming an officer and a gentleman and dismissed the service. The plea of the constitutional privilege of not being twice placed in jeopardy for the same offense does not apply, as has been repeatedly held by the Supreme Court of the United States. An officer or man who has been tried by the civil authorities and acquitted may, nevertheless, be taken before a court-martial and tried and convicted of the military features of the offense.

Although there is no express legislation on the subject, I am of the opinion that the naval militia of the different States are, by analogy to the militia, amenable to trial by courts-martial (1) when employed in the federal service "in time of war or public danger," and (2) when they commit the offense of refusing to be so employed.

The question as to when the militia were to be legally regarded as in the employment of the United States was decided by the Supreme Court in the case of Houstin vs. Moore to be "the formal muster into the United States service at the place of rendezvous," and the amenability continues until "discharged by proclamation of the President."

The amenability of the militia for refusal to comply with the call of the President is found in the Act of 1795, which was repeated in the Act of 1861, and found in Section 1649 of the Revised Statutes. What sort of a court-martial should try such an offender has been decided by the Supreme Court in the case of Houstin vs. Moore (5 Wheaton, 1, 25, 64-66), to be one composed of militia officers. This ruling has been subsequently affirmed by the Supreme Court in the case of Martin vs. Mott (12 Wheaton, 19, 34).

In the case last above cited the court held that the jurisdiction of the court-martial to try was not restricted to the period of war or public danger, but that the offender could be tried subsequent thereto.

Civilians Subject to Military Discipline in Time of War.

In the Navy the question of the amenability of civilians to naval discipline and trial by court-martial in time of war will arise much less frequently than in the Army, and perhaps not at all. Still as such a case might arise in landing parties, as well as naval forces serving on shore in detached parties, I have thought it best to give a brief outline of their amenability as applied to the Army.

The 63d Article of War provides:

> Article 63. All retainers to the camp, and all persons serving with the armies of the United States in the field, though not enlisted soldiers, are to be subject to orders, according to the rules and discipline of war.

This provision, coming with slight modification from the original code of 1775, which in turn was taken from the British articles of similar import, has been construed to make the persons coming within its description subject not only to the orders for the government and discipline of the command to which attached, but also to trial by court-martial for violation of the military code. It is but proper that these people, receiving the protection of the government, should be amenable to its rules and regulations.

The term "retainers to the camp" includes (1) officers' servants (when not enlisted); (2) camp followers attending the Army, but not in the public service. The camp followers are sutlers and their employés, newspaper correspondents, telegraph operators, etc.

The term "persons serving with the armies in the field" has been construed to mean those civilians who are in the employment and service of the Government. It refers to clerks, teamsters, laborers, hospital officials and attendants, interpreters, guides, scouts, as well as men employed on transports and military railroads.

Of course it has always been held that this article should be strictly construed, as it creates a certain military jurisdiction over a limited class of civilians. During our late war, however, numerous cases of this character occurred in the Army, and the jurisdiction of the court was invariably sustained so long as the civilians were "actually serving with the Army," and so long as the proceedings were instituted during the "*status belli.*"

Articles 45 and 46 of the Articles of War provide—

ARTICLE 45. Whosoever relieves the enemy with money, victuals, or ammunition, or knowingly harbors or protects an enemy, shall suffer death, or such other punishment as a court-martial may direct.

ARTICLE 46. Whosoever holds correspondence with, or gives intelligence to the enemy, either directly or indirectly, shall suffer death, or such other punishment as a court-martial may direct.

The word "whosoever" applies with equal force to civil and military persons, as has repeatedly been held by the courts after lengthy opinions on the subject.

Sections 4 and 5 of Article 4 of the Articles for the Government of the Navy provide—

The punishment of death, or such other punishment as a court-martial may adjudge, may be inflicted on any person in the naval service:

FOURTH. Who gives any intelligence to, or holds or entertains any intercourse with, an enemy or rebel, without leave from the President, the Secretary of the Navy, the commander-in-chief of the fleet, the commander of the squadron, or, in case of a vessel acting singly, from its commanding officer;

FIFTH. Who receives any message or letter from an enemy or rebel, or, being aware of the unlawful reception of such message or letter, fails to take the earliest opportunity to inform his superior or commanding officer thereof.

It will be noted that our articles are differently worded from those of the Army last above referred to, inasmuch as the Army articles refer to "whosoever" does the things therein mentioned, whilst in the Navy the words "any person in the naval service" are used. I have been unable to find any decision of the courts on this point, but I am of opinion, in view of the decisions in the Army, that the courts would liberally construe these articles so as to include those civilians who are attached to the Navy and who would for this purpose be in the "*naval service*."

As in the other sections above quoted the operation of these sections must be understood to be limited to acts committed on the theater of war or within the scope of martial law, during the *status belli*.

OFFENSES WITHIN THE JURISDICTION OF COURTS-MARTIAL.

With reference to offenses coming within the jurisdiction of courts-martial, it may be laid down as a general rule that the offenses cognizable are those made so by the Articles for the

Government of the Navy or by other statutes. The Articles for the Government of the Navy define not only the specific offenses which are punishable by courts-martial, but also those which are embraced under a general description. Thus the first clause of Article 8, after mentioning falsehood, drunkenness, theft, et cetera, makes the omnibus description "or any other scandalous conduct tending to the destruction of good morals." Again, Article 22 states, "All offenses committed by persons belonging to the Navy which are not specified in the foregoing articles, shall be punished as a court-martial shall direct," and under this general description are classed such offenses as "conduct to the prejudice of good order and discipline" and "conduct unbecoming an officer and gentleman." It is proper when the articles expressly make an offense cognizable to lay the offense under that article, but when in the opinion of the convening authority, an offense has been committed which is serious enough to be tried by a court-martial, and which does not come within the specific enactment of any of the articles, it may properly be charged as "conduct to the prejudice of good order and discipline," "scandalous conduct tending to the destruction of good morals," or "conduct unbecoming an officer and gentleman."

Again, under the head of "specific offenses," we find not only those which are crimes only in the military law, but also those which are crimes in the military as well as the civil law.

The former are desertion, absence without leave, mutiny, disobedience of orders, disrespect to superior officer, sleeping on post, et cetera; the latter are larceny, crimes committed with violence, embezzlement, frauds, et cetera. It must be remembered, however, that both of these forms of offenses are both criminal and military, they are criminal, because the jurisdiction of courts-martial is criminal, and military because all offenses committed by officers and enlisted men and cognizable by courts-martial are necessarily military offenses. But though they are both criminal and military, there is this further distinction as to purely military offenses, *i. e.*, the jurisdiction of the court-martial is *exclusive*, while of the others, except in time of war in a region under martial law, the jurisdiction is *concurrent* with the civil tribunals.

The specific offenses are further subdivided into those which

are peculiar to and punishable only in time of war, and those which may be committed and punished at any time, either in war or peace.

Another feature of the offenses cognizable by courts-martial is that although of a criminal character the common law distinction between felonies and misdemeanors does not prevail. They are neither the one nor the other, but simply military crimes. At common law a felony was a crime entailing a forfeiture of lands or goods, but in our country it is used to indicate a crime for which the punishment is either death or imprisonment in the penitentiary. A misdemeanor is any crime less than a felony.

At common law there is the distinction between principals and accessories, *before* and *after* the fact, but no such distinction prevails in military law, and all accused persons are treated as independent offenders, and although it sometimes happens that persons may be jointly charged and tried, as for mutiny, and each may be guilty of distinct participation calling for punishment, yet in the eyes of the military law all are principals.

Another distinction to be noted is that in courts-martial there are no statutory grades or degrees of offenses, as for instance there are no grades of desertion, mutiny or cowardice, although the circumstances of such offenses may differ greatly in criminality and may call for very different degrees of punishment.

A point which may be adverted to in this connection is that the jurisdiction of the greater offense carries with it that of the lesser offense. Thus, a man charged with desertion of which the court has jurisdiction, implies also jurisdiction of the lesser offense of "absence without leave"—so also murder and manslaughter, or robbery and larceny. The principle upon which this rests is that the court in trying the crime charged has jurisdiction of any minor criminal act recognized as an offense by law which it contains or involves.

Rules for Drawing up Charges and Specifications.

At this time whilst we are considering the offenses which come within the jurisdiction of general courts-martial it may not be amiss to invite your attention to the question of the charges and specifications, the instrument by which the offense or offenses are brought within the jurisdiction of the court.

The charges and specifications in military law are similar to the indictment in a criminal case in civil law, and as this is the groundwork upon which the superstructure is built, it is evident that too great care cannot be exercised in having them legally and technically correct in order that the technical demurrer or plea may properly be overruled by the court. I have, therefore, to ask your attention whilst I give a few fundamental rules bearing upon the manner of framing charges and specifications.

The officer ordering the court, after assuring himself that the offense is one which should be heard by a general court-martial, should carefully digest the alleged matter so as to have it fully in hand.

The first point to be decided is the gravamen of the offense, in order that it may be properly classed under one of the Articles for the Government of the Navy. This decided, the next point to be considered is the number of specifications, and the specific matter to be charged in each specification, for care must be taken that all the rules of pleading are complied with, so that a demurrer, if offered, cannot be sustained. It will be well, in drawing up charges and specifications, to see that the following rules are strictly followed: The specifications should allege only that which is culpable and which the prosecution is ready to prove; to avoid duplicity, each specification must allege a distinct offense, and allege it in a clear and definite manner; the specification must not be argumentative; if possible it should distinctly charge some specific violation of law or regulation; the specification must be clear, brief, and explicit, in order that the facts, circumstances, and intent may be set forth with certainty and precision, and especially must it be shown that the accused committed the offense; the accused must be described with the greatest accuracy, and to this end, his Christian and surname should be written in full, his rank or rating and his place of service should be distinctly stated; the time and place where the offense was committed must also be accurately set forth; but if the time or place are not absolutely known, then it is sufficiently definite to say "on or about" such a time, and "at or near" such a place, keeping in mind that only a reasonable time would be admitted as a limitation; the person against whom the offense is committed must be described with as much accuracy as the accused, but if the party is not known, then the

specification may very properly allege that the offense was committed against a "person unknown"; the intent which constitutes the offense must be set forth, and when the law has adopted certain expressions to show the intent, these technical expressions must be used; the acts alleged to have been committed must be stated with certainty; the specifications must be free from abbreviations, and no part should be in figures, but the entire matter must be written out; when written instruments form part of the offense they must be set out *verbatim;* when only the substance of a written instrument is alleged it is sufficiently definite to allege it with the introductory words "in substance as follows." Each charge should be numbered, unless there is but one, and if there be more than one specification to each charge, they should also be numbered. The charges and specifications should be signed by the officer ordering the court and should be followed by his full title, and the time and place of issuing the same.

We have now traced the distinctive peculiarities of general courts-martial, and I had hoped to be able to give you a skeleton form of procedure for such courts with such comments as were deemed necessary, but in the limited time allotted me it will be impossible to do so; but it is not of importance to discuss the question of procedure of such courts at this time, owing to the fact that the office of the Judge Advocate General has but recently issued an authoritative form of procedure, which as a reference book will, I think, give you all the information on this subject, especially as it is intended to cover every possible contingency which would arise in the course of the trial.

Evidence.

There is one other subject which is deserving of your very careful consideration, and which I shall be able to give but passing notice, and that is the question of evidence. You can readily see how important this matter is to officers who, as members of courts-martial, in their capacity of judges, must pass upon the *admissibility* of evidence and then as jurors weigh it. It is almost too much to ask of an officer to require him to digest the numerous and voluminous works on evidence, and yet he is often called upon to decide the most intricate points, which judges would find difficult of solution. It is a rare occurrence, however, to

find grave errors committed by courts in this respect, and the question is often asked how it is that laymen passing upon the rules of evidence make so few mistakes. The only answer which I can find is that the rules of evidence have as their foundation justice and common sense, so when the exact rule of evidence covering the point in question is not known, a safe course to follow would be to ask yourself, is it right that such evidence should be admitted, is it common sense that such evidence should be admitted, and if the answer be in the affirmative, the chances of error are a minimum. There are, however, a few important points to which I will ask your attention, and hope that what I say may lead you to desire a closer acquaintance with the subject which can only be gained by personal research.

Courts-martial are bound in general to observe the fundamental rules of law and principles of justice observed by the civil judicature, and are also upon trials to be governed by the rules of evidence of the common law as followed by the criminal courts of the country. But, however, as the essence of all military proceedings is summary and rigorous action, and, as before stated, courts-martial are not even courts in the full sense of the term, but simply bodies of military men ordered to investigate accusations, arrive at facts, and when just to recommend a punishment, they can scarcely be held bound to the same strict adherence to common law rules as are the true courts of the United States, and upon trials they may properly pursue a more liberal course in regard to the admission of testimony than do the civil courts. The purpose of a court-martial is to do justice, and if the effect of a technical rule is to exclude material facts and obstruct a full investigation, the rule may and should be departed from; but it must be remembered that the proper occasions for such departures will be exceptional and infrequent.

The question of evidence may be divided into four heads, I, proof in general; II, admissibility of evidence; III, oral testimony, and IV, written testimony.

I. PROOF IN GENERAL.

Under the head of proof in general is considered (1) what is to be proved; (2) how must it be proved; (3) what is to be presumed; and (4) what is to be judicially taken notice of.

(1). At the very outset let me remind you that in a military court as in a civil court the burden is on the prosecution to establish the guilt of the accused, and not upon him to establish his innocence. In thus establishing the guilt, it must be shown that the act charged was committed; that the accused committed it; and that he committed it with the requisite criminal intent.

(2). In a civil case the plaintiff need only make out a *prima facie* case, or offer evidence materially preponderating over that of the defendant in order to give him a verdict, but the burden of proof on the prosecution in a criminal case is much greater, owing to the presumption of innocence which always exists, and to this presumption is due the rule of criminal evidence that the guilt of the accused must be established beyond a *reasonable doubt.* As this question of reasonable doubt is one which arises in every case at military law, I will quote from Colonel Winthrop on this subject as follows: "By *reasonable doubt* is intended, not fanciful or ingenious doubt or conjecture, but substantial, honest, conscientious doubt, suggested by the material evidence in the case."

In the case of the United States vs. Newton (52 Fed. R., 390), the court held that "it is an honest, substantial misgiving, generated by insufficiency of proof. It is not a captious doubt, nor a doubt suggested by the ingenuity of counsel or jury and unwarranted by the testimony; nor is it a doubt born of a merciful inclination to permit the defendant to escape conviction, nor prompted by sympathy for him or those connected with him."

From these citations it will be seen that the meaning of the rule is that the proof must be such as to exclude not every possibility of innocence, but every fair and natural hypothesis except that of guilt. As stated in Greenleaf on Evidence, "What is required is not an absolute or mathematical but a 'moral certainty,'" and as laid down in Winthrop, "A court-martial which acquits because, upon the evidence the accused may *possibly* be innocent falls as far short of appreciating the proper *quantum* of proof required in a criminal trial as does a court which convicts because the accused is *probably* guilty."

(3). Under the head of "What is to be presumed," we find two classes of presumptions, those of law and those of fact. By presumptions of law are meant the general propositions established

by the law, which are accepted without evidence by the courts as being *prima facie* true. These are of two kinds, those which are conclusive and those which are disputable. By presumptions of fact are meant those inferences as to the existence of a fact derived from some other fact or facts—in other words, inferences deduced by the human reason.

(4). As to the matter of which the courts take judicial notice we find that there are many facts of a conspicuous general or public character which so authenticate themselves in law that the courts take judicial notice of their existence as matters of course and which are not required either to be charged or proved; thus a court-martial takes judicial notice of the Constitution, public statutes, proclamations, the power of the President and executive departments, matters of public history, the Navy Regulations, general and special orders and circulars of the Department.

II. ADMISSIBILITY OF EVIDENCE.

One of the most important subjects with which a member of a court has to deal is that of the question of admissibility of evidence, and I again urge upon you to give this matter the careful attention which it merits, as I can in this lecture give it but passing notice. The three principal rules as laid down by the authorities are (1) the evidence must be relevant, (2) the burden of proof is on the Government, (3) the best evidence must be produced of which the nature of the case is susceptible.

By being relevant is meant that the testimony must be apposite to the material averments of the specifications, and be such as to establish or tend to establish the commission of the offense alleged. It need not directly tend to sustain the charge, but if shown to be a link of the chain it is relevant and admissible.

Nothing need be said on the point that the burden of proof is on the Government, for I believe that this is thoroughly understood by all of you.

By the *best evidence* is meant not the greatest quantity of evidence, but the term applies particularly to the quality thereof. It means that the most authoritative and legally satisfactory evidence of which the case is capable is to be produced. In fine, whenever it appears that there is a higher and better grade of evidence than that which is introduced, the evidence is not admissible. A familiar example is the attempt to introduce oral

or parol evidence when written evidence exists and can be produced. There are, of course, exceptions to this rule, but unfortunately time will not permit my adverting to them; but I will refer to one exception which is familiar to all of you, and that is the introduction of parol evidence to prove the contents of a document which is lost or destroyed, or in the possession of the other side.

In connection with the requirement that the best evidence of which the nature of the case is susceptible must be produced, we must consider the subject of hearsay evidence, which, as described by Greenleaf, is "that form of evidence which does not derive its value solely from the consideration to be given to the witness himself, but rests also in part on the veracity and competency of some other person." This form of evidence is invariably inadmissible, but care must be taken in deciding that it is hearsay, for every statement made by a third person is not necessarily hearsay, but frequently original testimony and admissible. Thus, when the question at issue is whether certain words were actually spoken by a person other than the witness, a recital of the words by the witness is original testimony and admissible.

Another form of declaration of a third person which is admissible is that which forms part of what is legally known as the *res gestae*. By *res gestae* is meant the circumstances and occurrences attending and contemporaneous with the principal fact at issue, or so nearly contemporaneous with it as to constitute a part of the same general transaction, which explain and elucidate such fact by indicating its nature, motive, etc. No rule can be laid down which will be a guide as to what is and what is not a part of the *res gestae*. It is a matter which must be left to the wise discretion of the court. A declaration made even a few seconds after the occurrence of a fact has been held not to be part of the *res gestae*, whilst under other circumstances a declaration made a week or months after the fact has been held as part of the *res gestae*. Each and every case must stand on its own bottom, and, as before stated, must be left to the sound discretion of the court, which of course is guided by the circumstances attending the case.

Courts are frequently called upon to pass upon the question of the admissibility of confessions made by the accused, and as a rule it may be stated that a confession is inadmissible unless

it be clearly shown by the prosecution that it was *voluntarily* made and not induced or materially influenced by hope of release or other benefit, or fear of punishment or injury, inspired by one in authority. The court is allowed to take testimony to ascertain the absolute conditions under which a confession is made in order that it may decide as to its being a voluntary act on the part of the accused. Again, before a confession can be admitted in evidence the *corpus delicti* must be proved.

Another point which frequently arises is that which goes to the competency of a witness, and it may briefly be stated that whilst formerly many persons were deemed to be incapacitated to testify, the rules in this respect have been relaxed, and I know of no class of persons who are incapacitated to testify before a court-martial except idiots, insane persons, persons in state of intoxication, very young children, and wives of accused persons. What was formerly a question of competency is now a question of credibility, which will be later alluded to.

Formerly in criminal prosecutions the accused could not testify, but by the act approved March 16, 1878, it was provided that the "Accused shall at his own request, but not otherwise, be a competent witness, and his failure to make such request shall not create a presumption against him." Care must be exercised by courts that the accused does not take the stand for any purpose except at his own request, and the record must invariably show this fact; if it does not it is a fatal error. With reference to the fact that no presumption lies against the accused on account of his failure to testify, the Supreme Court held that it was not allowable to make "comment, especially hostile comment, upon such failure," to the jury. "The minds of the jurors," it was further held, "can only remain unaffected from this circumstance by excluding all reference to it" (Wilson vs. United States, 149 U. S., 60). In like manner it may be said that it is highly improper for the Judge Advocate to comment upon this fact in summing up the case for the prosecution.

III. ORAL TESTIMONY.

The question frequently arises as to whether courts-martial being unable to secure the oral testimony of witnesses can have depositions introduced, and in reply it must be stated that depositions are inadmissible, as the law requires that the witness be

sworn by the president of the court and give his testimony to the court. The Department has for the past four years at each session of Congress submitted to that body the draft of a bill authorizing courts-martial, under certain circumstances, to receive depositions, but thus far it has been unable to secure favorable action from that body on this subject.

A witness may be allowed to refresh his memory by reference to a memorandum so long as it was made by him at the time of the fact or transaction to which it refers, or so soon afterwards as to afford the presumption that the memory of the witness was fresh at the time of making it. If the paper is not one made by the witness, it must appear that after inspecting it he can speak of his own recollection, otherwise he cannot use it. The privilege of using a memorandum does not authorize the witness to read his evidence from notes previously made.

Witnesses must confine themselves to statements of facts to the best of their knowledge and belief; opinions are not admissible except in two cases, the one being when a certain matter of fact resting wholly on belief is directly at issue, as the question as to whether a writing is or is not in the handwriting of a certain person, and the other being the testimony of experts on questions of science, or other questions requiring for their solution a peculiar skill or knowledge of a specialty.

A rule of evidence which frequently arises is that a party is not permitted to impeach the credibility of his own witness, but this must not be construed to mean that he cannot introduce other testimony as to a particular fact which is directly contradictory to the testimony of such witness.

Another rule is that in the direct examination leading questions must not be asked except where a witness is shown to be hostile to the party calling him, or where a witness's memory is so defective that he cannot recollect or specify a certain material fact.

On cross-examination, however, leading questions are admissible.

The cross-examination of a witness must be confined to the matter brought out in the direct examination and must not be extended to collateral matter with a view to contradict the witness by other evidence and thus discrediting him. Of course the right of cross-examination as a test of the perception, obser-

vation, recollection, and veracity of the witness is one which should not be denied and, therefore, for this purpose great latitude should be allowed.

When the accused, at his own request, goes on the stand, the greatest latitude is allowed in the cross-examination, which need not be restricted to the matter brought out in the direct examination, and in fact should not be restricted in any way. Very few cases arise in which counsel for the accused do not raise objection to the cross-examination of the accused, and contend that it must be restricted in the same manner as any other witness, but this is not true, and courts would err in sustaining such objection. On this point the Supreme Court has held: "A greater latitude is undoubtedly allowable in the cross-examination of a party who places himself on the stand than in that of other witnesses."

An established principle of the common law which has been affirmed by our Constitution is that a witness, whether the accused or any other witness, must not be required to answer a question that would criminate him; the witness can, if he desires, waive this protection.

In weighing the evidence of the accused, when a *prima facie* case has clearly been made against him by the prosecution, it is safe to rule that entire credit should not be given to his statements except in so far as he is corroborated by unprejudiced witnesses or reliable written testimony.

The question of the *credibility* of the testimony given by a witness is a most important one, for upon it rests the decision of the court in its capacity of jurors as to the proof of the various allegations. A witness is entitled to full weight for his testimony unless it can be impeached by the other party. How successful the impeachment has been made is a question entirely within the sound judgment and discretion of the court. Even when the character for veracity of a witness has been shown to be bad, his testimony is not to be wholly disregarded, but is to be considered in connection with the rest of the testimony and such credit given it as it appears to be entitled to receive. Also, when a witness has been shown to have testified falsely to a certain particular, the maxim, *falsus in uno, falsus in omnibus*, need not be applied, nor all his testimony disregarded, but it should be weighed in connection with the other testimony, and especially

so when corroborated. The general manner and bearing of a witness is an important consideration in weighing his testimony.

The relative number of witnesses for the prosecution and defense is by no means decisive in general, as the relative weight of the evidence depends much less upon the number of the witnesses than upon the quality of their statements.

IV. WRITTEN TESTIMONY.

The question of public and private writings in evidence is a very extended one.

Public writings are generally divided into judicial records and other public documents. Judicial records are admissible under the seal of the court.

Other public documents consist of acts of the legislature and executive departments of the Government, such as the acts of Congress and congressional debates and proceedings, executive proclamations, orders, communications to Congress. The Revised Statutes of the United States and the Statutes-at-Large are *prima facie* evidence of the law contained therein. A statute of Congress not yet published is proved by copy under seal of the State Department. General orders of the Department carry on their face their authenticity, and are receivable in evidence.

By private writings are meant contracts, deeds and other personal written instruments and obligations. The papers tendered to be introduced must be shown to be genuine, and if a copy, to be a true copy, and the handwriting must be proved.

I have endeavored to give you a brief outline of some of the more important rules of evidence, and such as most often occur in the proceedings of courts-martial, but you can easily realize that in the limited time allotted only a very superficial treatment of the subject can be given, but I trust that I have sufficiently shown the many interesting features, to offer you an inducement to continue your study of this very important subject.

With this review of the subject of general courts-martial I pass to the other tribunal of justice in the Navy—the summary court-martial.

Summary Courts-Martial.

In our service summary courts-martial were first authorized by the act entitled " An act to provide a more efficient discipline

for the Navy," approved March 2, 1855, and the provisions of this act as reaffirmed in the act approved July 15, 1870, constitute the authority for the jurisdiction and powers of our present summary courts-martial.

The summary court-martial is a court of very limited jurisdiction, and is to be resorted to only in those cases where the officer ordering it believes that the offense committed is one which is deserving of greater punishment than he is by law authorized to inflict, and still not sufficiently grave to warrant the offender being tried before a general court.

The authority for the convening of summary courts-martial is found in Article 26 of the Articles for the Government of the Navy, which provides—

ARTICLE 26. Summary courts-martial may be ordered upon petty officers and persons of inferior ratings, by the commander of any vessel, or by the commandant of any navy yard, naval station, or marine barracks to which they belong, for the trial of offenses which such officer may deem deserving of greater punishment than such commander or commandant is authorized to inflict, but not sufficient to require a trial by a general court-martial.

This, as in general courts, plainly defines what officers are authorized to order such a court.

The composition of such courts is controlled by Article 27, which provides—

ARTICLE 27. A summary court-martial shall consist of three officers not below the rank of ensign, as members, and a recorder. The commander of a ship may order any officer under his command to act as such recorder.

The procedure to be followed by summary courts-martial is in many respects similar to that of general courts, and as it is also set forth in the publication before referred to, I will simply ask your attention thereto, without in any way attempting to discuss it. It must be borne in mind that so far as the suggestions for drawing up specifications and the rules of evidence are concerned they are just as applicable to summary courts as to general courts.

As has just been indicated, summary courts are courts of limited jurisdiction, and in awarding a sentence they are restricted to the punishments as set forth in Article 30 of the Articles for the Government of the Navy, and here it may be well to state

that one of the most frequent errors made by summary courts in awarding sentence is to combine parts of the seven punishments which they are permitted to inflict into one sentence. The decisions on this point, which are numerous, are to the effect that any one of the seven punishments may be given, but when given it must be given in its *entirety*, to which, however, may be added extra police duties and loss of pay as authorized in the eighth clause of the Article. As a familiar illustration, the second clause of Article 30 provides for a punishment of "solitary confinement, not exceeding thirty days, in irons, single or double, on bread and water, or on diminished rations." Courts frequently award the solitary confinement on bread and water, but do not include in the sentence "*in irons*," single or double, which is a part thereof, and as a consequence such sentences are, whenever practicable, disapproved by the Department.

The action upon the record of the officer who ordered the court is so clearly defined in Articles 32 and 33 of the Articles for the Government of the Navy that a reference thereto seems to be all that is necessary.

As stated in Article 34 of the Articles for the Government of the Navy, the proceedings of summary courts-martial are to be conducted with such conciseness and precision as is consistent with the ends of justice. They are intended to be, as their name indicates, a summary method of administering justice.

Courts of Inquiry.

We will now briefly review the Courts of Inquiry as they exist in our service.

The act entitled "An act for the better government of the Navy," approved April 23, 1800, provided that "courts of inquiry may be ordered by the President of the United States, the Secretary of the Navy, or the commander of a fleet or squadron, provided that such court shall not consist of more than three members, who shall be commissioned officers, and a judge advocate or person to do duty as such, and such courts shall have power to summon witnesses, administer oaths, and punish contempt in the same manner as courts-martial." The act further provides that "such courts shall merely state facts, and not give their opinion unless expressly required to do so in the order for convening, and the party whose conduct shall be the subject of

inquiry shall have permission to cross-examine witnesses." The provisions of this act were subsequently reaffirmed by the act approved July 17, 1862, which is the source of the jurisdiction of our courts of inquiry at the present time. The wording of the act is so clear that no comment thereon is necessary, as the source of jurisdiction, the composition and powers of such tribunals are concisely stated.

Courts of inquiry are resorted to in important cases, when the facts are various and complicated, when there appears to be ground for suspecting criminality, or when crime has been committed, or much blame incurred without any certainty on whom it ought chiefly to fall, in order to collect, sift and methodize information for the purpose of enabling the convening authority to decide upon the necessity and expediency of further judicial proceedings. It might be well to state here that the object of a court of inquiry is simply to give information to the officer ordering it, and is in no wise considered as a decision on the subject which is binding, and in its scope is not restricted by statute of limitation to any time subsequent to that at which the matter to be inquired into occurred. In fine: a court of inquiry is simply the medium through which the officer ordering it expects to get at the absolute facts in the case in order that he may determine whether or not further action may be necessary.

The composition of the court, either in regard to the rank of its members or the department of the service to which they belong, should be regulated by the circumstances to be inquired into. If the conduct or character of an officer is to be inquired into, the members of the court should not be, if possible, inferior in rank to that officer. If the officer be one of the staff corps, or the marine corps, it is proper, if the exigencies of the service will permit, that one or more officers of his corps should be detailed on the court.

As to the question of procedure of courts of inquiry I again invite your attention to the forms of procedure before mentioned, which fully cover all the different kinds of courts of the character that can be organized. It may be well to state, however, that in one material respect this form of court differs from general and summary courts-martial, and that is that while the Judge Advocate of a general court-martial and the recorder of a summary court-martial are required to withdraw when the

court is closed, the Judge Advocate of a court of inquiry is permitted to be present at all times and does not withdraw.

It may be well to state that the court should always keep in view the fact that the purpose for which it is organized is the examination of witnesses under oath in order that the absolute facts of a case may be determined for the information of the convening authority, and that the proceedings should be orderly and conform with those of other judicial bodies.

As was stated above, a court of inquiry is simply convened to gather information for the convening authority, and it is entirely within the discretion of such convening authority to be guided or not by the finding and recommendation of the court, so that although a court should recommend that no further action be taken, the convening authority can nevertheless, if he deem it proper, take further action and *vice versa*.

Article 60 of the Articles for the Government of the Navy provides that—

> The record of proceedings of a court of inquiry shall, in all cases not capital, nor extending to the dismissal of a commissioned or warrant officer, be evidence before a court-martial, provided oral testimony cannot be adduced.

Numerous cases have arisen in which the Judge Advocate of a general court-martial endeavored to introduce the record of a court of inquiry as evidence before a court-martial, and the court being apparently unable to decide how far the above provision of law is applicable, the Department finally, in General Court-Martial Order No. 88, dated October 21, 1895, laid down for the guidance of courts its decision in the premises, and to this order I invite your careful attention. It is in effect that unless the charge be laid under an article for the government of the Navy which in case of conviction makes it mandatory upon the court to give a sentence of death or dismissal, the record of a court of inquiry is admissible in evidence provided it be shown that parol evidence can not be introduced. For the purpose of impeaching a witness it is always admissible, provided that a proper predicate be laid.

An officer whose conduct is to be investigated by a court of inquiry need not be put under suspension or arrest for that purpose, but it is proper for his superior officer to excuse him from his ordinary duties during the investigation.

The "party accused" is entitled to be present (with counsel if desired) so as to take part in the examination of witnesses and to introduce evidence, but his presence is not at any stage obligatory or essential. He is sometimes, though rarely, ordered to be present, and in that case he must attend, although his absence may not affect the authority of the court to proceed. He may, at his own request, take the stand as a witness, but he cannot be compelled to do so.

The reviewing authority, upon the receipt of the record of proceedings, may, if he deem it proper, return it to the court for revision, and, unlike a court-martial, new evidence may be received and recorded on every occasion; and the court may recall and re-examine any of the previous witnesses with a view to eliciting all possible information which the case admits.

We have now briefly reviewed the law by which the Navy, as a separate community, is governed, and also the various tribunals by which it is administered, and whilst I feel that it has been of an extremely superficial character, yet I trust that sufficient has been shown to arouse in you a desire for further research, and if I have succeeded to this extent I shall feel that my work has not been in vain. I will, therefore, in conclusion, recommend to your earnest consideration, from amongst the numerous authorities, as books of reference, Winthrop's Military Law and Precedents; Greenleaf on Evidence; and the Forms of Procedure, issued by the Office of the Judge Advocate General of the Navy, as these will furnish substantially all the information which is necessary to the student of military law.

My thanks are due to Colonel W. Winthrop, U. S. Army, from whose valuable work "Military Law and Precedents," much of the information upon which these lectures are based was taken.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

IMPROVEMENTS IN ORDNANCE AND ARMOR IN THE RECENT PAST AND FUTURE.*

By P. R. ALGER, Professor of Mathematics, U. S. Navy.

To-day I ask your attention to a discussion of the question of the accuracy of gun fire and the steps which have been and yet remain to be taken to increase it.

Strange as it may appear, it is in this direction that the greatest progress has recently been made, and it is in this direction that the greatest possibilities of improvement still lie. The use of a practicable telescope sight on naval guns, and the introduction of efficient methods of controlling their fire in action, will, in my opinion, so greatly increase their efficiency as to dwarf the importance of the other ordnance developments of recent years.

It has long been recognized by those who have investigated the subject, that it is physically impossible for the human eye to judge when three points at widely different distances are in one straight line, yet this is the thing which must be done every time a gun is sighted by the usual means; and upon the accuracy of the judgment depends almost entirely the accuracy of the fire of the gun. The errors of the gun itself are as nothing in comparison with the errors of pointing, due to mistaken judgments of distance, speed and wind force; but even these errors sink into insignificance when compared with the errors caused by firing the gun when the line of sight does not pass through the target.

Practice makes perfect is almost universally true, but it is a well-known fact that the good shot is usually born so and not

* Lecture delivered before the Naval War College, Newport, R. I.

made so. The majority of men never can be taught to shoot well, and no man can shoot so well with the ordinary sights as to make the errors of modern guns of any importance whatever. With the telescope sight this is all changed. Every man, whether his eyes be good or bad, if he can see at all, sees, when he looks through the telescope at the target, two things: one, the image of the target, the other, the cross-wires in the telescope; and the image and the wires are in the same plane, so that as the movements of ship, gun and target change their relative positions, no man can possibly fail to distinguish and know when the cross-wires cover the image of the target; and if at that moment the gun be fired, then, barring the errors of the gun and the errors of estimation of distance, speed and wind force, the shot must strike the target. In other words, that error in firing guns which is so great as to mask all others, namely, the personal error of the gun pointer, is eliminated by the use of the telescope sight.

As a rough estimate, I should say the mean error of one of our large guns, measured on a vertical plane, is about one yard at a range of 2000 yards; or if gun and target are stationary, sights set for correct range, and line of sight pointed exactly at the center of the target, no shot will strike more than about three yards above or below, to the left or right of the center; and the mean of the vertical errors, as well as the mean of the horizontal errors, if a number of shots are fired, will be about one yard. These errors evidently are so small as to be negligible. In actual service we have additional errors due to lack of precise knowledge of distance, of relative motion of gun and target, and of force of wind. At 2000 yards range the deviation due to a stiff breeze at right angles to the line of fire will not be more than four or five yards. At the same range, and supposing gun and target to be passing each other at the rate of 30 knots, the deviation of the point of fall due to this motion will be 50 yards. In other words, with no attempt at correction, the lateral error in an extreme case may be 55 yards. It hardly seems too much to expect any person, after reasonable experience, to estimate the total lateral correction within 50 per cent., which would make 27½ yards an *extreme error*.

The speed at which his own vessel is to be fought should be known to each gun pointer, as well as how much, and in what

way, he is to allow for it, and this, taken together with the roughest guess at a correction for the enemy's speed, and with no allowance for wind, should reduce the *mean* lateral error caused by imperfect knowledge of speed and wind corrections to certainly not more than 10 yards. A scale graduated for speed in knots affords a fairly accurate means of correcting for relative movements of gun and target, especially as this makes the correction practically independent of distance. However, with careful instruction and practice, the gun pointer should learn to make the correction within the limits above by pointing to one side or the other of the center of the target. In doing this no attempt at calculation need be made, and the effect of wind may be entirely disregarded. The gun pointer need only know the deviation at 2000 yards resulting from the speed of his own ship when the line of fire is abeam, and by following the rule of aiming at the middle of the enemy when both ships are moving in the same general direction, and ahead of the middle of the enemy by the amount of that deviation when both ships are moving in opposite directions, he will come near to making the proper lateral correction. For example, the correction for beam fire from a 15-knot ship is 25 yards at 2000 yards range. Then, on such a ship, let the gun pointers be simply taught to always fire at the middle of an opposing ship when she is steaming in the same general direction as they are, and to fire at a point ahead of the middle of the opposing ship when she is steaming in an opposite direction to their own, the distance ahead of the middle to be 25 yards at 2000 yards range, 12 yards at 1000 yards range, and 37 yards at 3000 yards, and even such a crude method of correcting as this will reduce the mean lateral error due to relative movements of gun and target and to wind force within the limit before stated, 10 yards. As for the vertical error, due to setting the sight bar for the wrong distance, the mean value of this, of course, depends entirely upon how closely distance can be determined and communicated to the gun pointer. Theoretically, it would appear well to use a range finder and range indicators, by means of which, as long as everything was in working condition, the sights could be set with an error of about two per cent. of the distance, which, at 2000 yards, would *only* cause the comparatively insignificant vertical error of less than one yard with our larger guns.

If we reject instrumental aid altogether, and make no effort to correct the range by observing the fall of the shot, then, since the mean error of the best judges of distance is said to be about 15 per cent., we should have, under the same conditions, a mean vertical error of some seven yards, which is, of course, a very serious one. But suppose that we have means of determining distance within 5 per cent.—and undoubtedly a practised observer watching the points of fall of the shot fired by well-trained guns' crews can judge distances within 5 per cent.—then the mean vertical error from this cause will be only about two yards.

Thus we see that with very simple and crude methods of estimating range and correcting for speed and wind, the mean vertical error should not exceed 7½ feet, nor the mean lateral error 30 feet, at 2000 yards range, *provided only* that the gun is fired when its line of sight passes through the target. In other words, at 2000 yards range the percentage of hits on a target 15 feet high and 60 feet long, if its center be pointed at, should be 50, and every shot should strike a target 45 feet high and 180 feet long.

But we all know that such a percentage of hits is never actually attained in practice, and in the excitement of action, judging from past experience, we would hardly expect 10 per cent. of hits at 2000 yards range. Admiral Ito is quoted as saying that the percentage of hits at the battle of the Yalu was about 10 per cent. for the Chinese and 15 per cent. for the Japanese guns, but the fact that out of 197 12-inch projectiles fired from the two Chinese ironclads, only seven struck Japanese vessels, hardly supports this estimate. In that action the firing was so wild that among its earliest results was the destruction of the men in an armored top by the bursting of a large shell and the cutting away of almost all the halliards on the Chinese ships. It is not to be supposed that a large gun was intentionally aimed at the enemy's top, and, in fact, the action was fought almost entirely at such long range as to make this supposition absurd. Most of the damage done aloft was by ricocheting shell and fragments of shell which had burst on impact with the water, and not by the direct hits of projectiles.

Now, what I contend is, that such bad shooting has been principally caused by using sighting arrangements so imperfect as to make it impossible for any man, however careful and cool, to

determine exactly when his line of sight is on, while with the telescope sight no man can help knowing when the line of sight is on. Of course great skill is required to so handle the gun as to bring its line of sight on, and excitement and impatience will frequently cause men to fire without waiting till the proper moment, but the fact remains that with the telescope sight for the first time it is possible to know the proper moment for firing. The skill which is now needed is that which can be acquired by exercise and drill in pointing guns at moving objects, and in no other way. Let a man be given sufficient practice with a gun, so that he is able to rapidly bring the line of sight upon a moving target; give that man the range within 5 per cent., and he has then only to have sufficient coolness and self-restraint not to fire except when the line of sight is on and he will hit a battle-ship at 2000 yards with almost every shot. Of course it is no easy thing to point a heavy turret gun accurately; a turret weighing 500 tons cannot be stopped and started instantaneously; but with practice sufficient skill can be acquired, and in no other way. To take advantage of the relative motions of gun and target by stopping the turret with the line of sight ahead of the target and firing as it comes on, or to train slowly in the same direction as the target is moving and fire as the line of sight comes up and slowly passes across the target, these are things which no man can do well in time of excitement unless he has done them thousands of times before in exercise. But any intelligent man can do them well if he has had sufficient practice, and if he does them well, he can, with the telescope sight, do such shooting as has never before been done with a gun at sea.

Another bar to accurate shooting at sea which has been partially overcome is the necessity of allowing for the time interval between the moment of willing to fire the gun and the actual discharge of the projectile from its muzzle. It has been, and I suppose still is, the custom of men who fire guns at sea to pull the lock-string just before the line of sight comes on, thus introducing a considerable personal error. This should no longer be done now that electric firing has been brought into use. With the electric firing key in his hand, the gun pointer has only to press the button, or otherwise close the circuit, when the cross-wires are at the center of the image of the target, and he

need have no fear that the roll of the ship will deflect his aim to a serious extent.

With percussion firing mechanism, the time which elapses between the first movement of the hand on the lock-string and the fall of the striker may vary from .02 to .11 of a second according to the expertness of the man and the efficiency of the firing arrangements, and the probable mean value of this interval leads us to conclude that with a ship rolling very moderately, a vertical error of 4 or 5 yards may easily result from this cause. Moreover, the attempt to correct for this by pulling just before the line of sight comes on is likely to introduce even larger errors, and, what is also important, irregular ones. Of course no system of firing can overcome the error due to the time it takes the projectile to traverse the bore, but this is only about one-third of the total error, and the other two-thirds, due to the time it takes to fire, practically disappear with electric firing. It may be said that the errors referred to would not exist if the well-known rule of firing at the end of the roll were followed, but such a rule cannot be followed strictly. If the gun be so laid that the sights come on at the end of one roll, perhaps the next two or three rolls do not bring them on at all, and so the rate of fire is greatly diminished. Men should be instructed, therefore, to follow the rule only to the extent of pointing so that the sights come on *near* the end of the roll, never at its middle, when the speed of roll is greatest. And here again we see the great value of practice in pointing guns under service conditions; the man who has sufficient skill—and this can only be gained by experience—to so point his gun that the line of sight comes on near the end of the ship's roll, thereby eliminates a source of error so important that it has been deemed wise to introduce the system of electric firing solely to reduce this error. Moreover, the longer the gun, the greater the error to be overcome is.

It must not be supposed, however, that all these great advantages can be attained at once and without accompanying disadvantages and sometimes mistakes. In the first place, it was very difficult to obtain a telescope of large field and yet otherwise satisfactory, and those first issued had a field of only 4°, which is entirely inadequate. With such telescopes, the ordinary rolling and pitching throw the target completely out of the

field of view, as does also a small relative lateral motion, and this makes it extremely difficult to get the image of the target at the cross-wires. The telescopes now being issued, however, have a field of 17°, which makes pointing easy, since the target remains in the field of view except when the rolling is very heavy.

Then again, much complaint is heard as to the unreliability of electric firing under service conditions. Electric batteries run down, circuits are broken, wires short circuit, primers fail, and things generally fail to work on some ships, and then the system is condemned. The fact is that electric firing does necessitate much more complex attachments than firing with percussion or friction primers, and it does take correspondingly more care and attention to make such a system work well; but it can be done, and it is well worth working for. Our original electric firing attachments were deficient in strength and were too complicated; moreover, the mistake was made of not issuing enough spare electric cells; also some of the earlier lots of electric primers were defective. Even with these, however, from some ships perfectly successful and efficient results have been reported at every target practice, showing what can be accomplished even with poor material by taking pains.

Now we have electric primers which can be counted upon never to fail; we have improved the attachments, and we issue a large number of spare cells to each ship. Consequently, with a reasonable amount of attention, electric firing should prove to be just as reliable as percussion firing has long been.

Another point of advantage with the telescope sight is that it will be far more efficient at night than an ordinary sight.

But after our ordnance material has been perfected to the highest practicable point, after our individual gun pointers have attained the highest possible proficiency in target practice, there is still a vast and, unhappily, almost unexplored field for development in the practical working out and perfecting of a system for controlling and regulating the fire of the battery as a *whole*. What the best way of doing this is depends, of course, very largely upon the design of each particular ship, and it is unfortunate that in making these designs in the past but little attention was paid to the important matter of so arranging their batteries as to make control possible. If each gun is in a com-

partment by itself, and widely separated from the other guns, it is still possible to install a system of communication, electric or other, whereby the range and other needful directions may be sent from a central station to each gun. But such a system would almost certainly break down early in an action; the wires or tubes running from end to end of the ship and through numerous bulkheads would soon be cut or injured, and all communication, except by messenger, would be cut off. It cannot be supposed that range can be accurately judged or points of fall of projectiles observed from a closed turret or through a small port on a covered deck. Cut off from knowledge of the distance of the enemy, ignorant of whether their shot are falling short or over, and with no one to regulate the rate of their fire, the best trained men are likely to throw away their ammunition. What we need is some simple system, independent as far as possible of tubes and wires, whereby an officer, trained in the art by frequent practice, shall be able from a commanding position to direct and control the fire of the whole battery. Having devised such a system, all drill and all target practice should be conducted with a view to perfecting officers and men in its use.

It seems to me that the commanding officer of a ship in action has enough to do in handling his ship, manœuvring as directed by signal, or independently, as the case may be. To keep the enemy constantly on a bearing which will allow the most efficient use of the greatest possible number of his guns is a sufficient problem to keep a commanding officer occupied in a single action, as it would also be in a fleet action to follow the directions of the commander-in-chief; while in either case he must be prepared to use his torpedoes, to attempt to ram, to manœuvre to avoid ram or torpedoes, and generally to meet any emergency which may arise. I should therefore advise that on each ship an officer be appointed to the important duty of directing the gun fire. This officer, with one or more assistants, must have a station from which he can observe the fall of shot, measure or estimate range, and communicate directions to the guns, and no other place seems to me to compare in advantage for this purpose with a lofty top. I would, if necessary, give up entirely to this purpose one or both of the tops in which we now carry machine or R. F. guns. It would seem possible to

so place a mast or masts on board any ship as to give one top which will always be clear of smoke from the funnels, and so high as to be fairly safe from injury by the enemy's fire. From this top, or from each of them if there be two, should lead such permanent tubes and wires as will give the communication best suited to the particular ship. Range indicators like the Fiske, having their faces graduated for ranges and also for certain specified directions controlling the fire, will probably be the best method of communication, but there should always be means of rapidly replacing cut wires, or, perhaps better, a second system of wires could be kept ready and put in place as a regular thing in clearing ship for action. If nothing better can be gotten, a system of signals by bugle or drum could easily be made to work well on many ships. On turret ships there would of course be an indicator in each turret with permanent wires, and the second circuit could be by wires direct from the top through the turret roofs. As a means of measuring range, the sextant for a first observation, and the stadimeter, after the height of the enemy's mast or stack has once been determined, should be fairly efficient. Or any of the single station range finders, like the Barr and Stroud, will do. The disadvantage of the Fiske range finder is its requirement of two stations with a wide distance apart. As installed at present, it seems certain that these range finders would be put out of action almost at once, and if two tops are available, placing the observing stations in them would certainly increase the likelihood of their escaping injury. Of course in a single action one accurately measured distance transferred to the stadimeter is sufficient, and therefore the range finder may be dispensed with, but in a fleet action this would not be the case, as the different phases of the combat would bring different adversaries to each vessel. Even with no instruments, however, good work can be done with experience, provided the guns' crews have been trained to the system. I spoke a moment ago of the irregularity of the errors caused by attempts to allow for the firing interval as being a special disadvantage, and what I meant was that for good battery practice it is above all important that all the gun pointers shall shoot alike. In other words, their training should be directed to the end of making them shoot uniformly. If you can count upon every gun pointer in the ship dropping his shot at about the

same place with the same sight bar setting, then it makes not an iota of difference whether he shoots 500 yards over or 500 yards short, provided the sight bar settings can be regulated by a person who sees where the shot are falling. With the ordinary sights it was actually impossible to attain this desirable end or even to approach near to it, although constant aiming drill would always result in great improvement. But with the telescope sight and electric firing the desired end is possible, and it only remains to teach the men two things and we come near to perfection. The first thing is easy enough—it is merely that the sight is always to be set as directed by the officer controlling the fire of the battery, and is never to be changed because the individual gun pointer or divisional officer thinks his shot are going over or short. In other words, in order to direct the fire with any approach to efficiency, the controlling officer must be able to count upon all sights being set as he directs and only changed as he directs. The second thing, however, is not easy, and, in fact, never can be taught or acquired completely—it is not to fire except when the line of sight is on the target. With the telescope we can tell when this is the case, which we could not do formerly, but with any and all forms of sight we have to contend with the excitement and impatience of the gun pointer. Perhaps the motion renders it difficult to get the line of sight on, or smoke obscures the view and only allows an occasional glimpse of the enemy, and in the excitement of action the gun captain cannot wait patiently, as he may be trained to do in target practice, but takes his chance, fires blindly and loads again. I say this cannot be entirely prevented, but still practice and instruction in peace time can at least reduce it to a minimum, and even in the heat of action the warning notice from aloft that they are shooting wildly will have its effect on well-trained men.

These three requisites, then, are essential for efficient work on the part of a gun pointer: 1st. He must set his sight as he is told. 2nd. He must be able to quickly bring his line of sight on to the target. 3rd. He must not fire until his line of sight is on the target. The 1st and 3rd of these requisites can only be attained as the effect of discipline and training on selected men, and the main object of all the routine of exercise drill and daily life on board ship should be to instill into the men those habits

of obedience and readiness which will cause them to do what they are told to do even in the most trying moments. The third requirement—that of ability to quickly bring the line of sight on the target at sea—is wholly a matter of actual practice with the guns themselves, and lack of this ability on the part of the gun pointers on any ship should be considered a reproach to the commanding officer of that ship.

But there is one other thing which the gun pointer must be taught, and that is what part of an opposing ship to aim at. It appears to be quite a generally held opinion in our service that the point to aim at should be different for different guns, or, in other words, that gun fire should be "discriminating," the heavy guns being directed against the armored portions of an adversary and the lighter guns against his unarmored parts. Not only in the contributions of naval officers to our own publications, but in professional articles in foreign papers, it is of frequent occurrence to read such statements as the following: "The opening range being too great to admit of piercing the heavy armor of a battle-ship, shell should be used and the unarmored or lightly armored portions of the enemy should be the target," and "He (the commanding officer) should designate the various parts of the enemy's vessel as targets for each caliber and see that the officers understand how to change the point aimed at according to the construction of the enemy's vessel." Moreover, in the opinions of a number of officers for and against the superimposed turrets of the Kearsarge and Kentucky, the principal objection urged was the impossibility of simultaneously pointing the 8-inch and 13-inch guns against different parts of the enemy. Now in my opinion discriminating fire from naval guns under service conditions is usually both impracticable and injudicious. I believe that the best results will be obtained, at least with the larger guns, by always aiming at the middle of the target, except in so far as an attempt is made to correct for wind and speed, and this for two reasons.

First, a consideration of the apparent size of a ship at such a distance as is likely to be used in naval engagements shows the impracticability of nicely selecting particular portions of her structure as the point of attack. The Indiana, for example, when broadside on at 2000 yards range, looks to be of the same size as a picture of her, eight-tenths of an inch long, held at the

point of clear vision, some 14 inches from the eye, while the outlines of the real ship will be much less clear and distinct than those of the picture. About one-half of the length of the Indiana at the two ends, having a freeboard of 11 feet, would show in the picture as about one-fortieth of an inch high, while the highest portions, excepting stacks and mast, would appear but about one-fifteenth of an inch high. Now when it is remembered that the line of sight is moving rapidly up and down as the ship rolls, and at the same time to the right or left as the ship and her opponent pass each other, so that it is constantly describing a more or less sinuous curve, at one instant pointing far above the target and at the next far below it, the difficulty of selecting the point to aim at with any nicety will be at once recognized. Assuming, for example, the very moderate roll of 4° each way from the vertical, a rolling period of eight seconds, and a relative motion of ship and target of only 10 knots per hour. Then, taking the Indiana at 2000 yards as the target, the line of sight every eight seconds will range over about 850 feet vertically and 130 feet sideways, and as it passes across the target, will occupy only about one-tenth of a second if it crosses near the ends. The most skillful man cannot hope to keep his line of sight constantly trained on a particular part of the length of the enemy, consequently as the roll causes the line of sight to pass up and down across the target, each time it will be at a different part of her length, and if the point aimed at be near one end, the greatest skill will not prevent the line of sight from frequently not crossing the target at all. Thus even if finally the gun is fired as it points at the selected part, much time must be lost in vain attempts to attain this end.

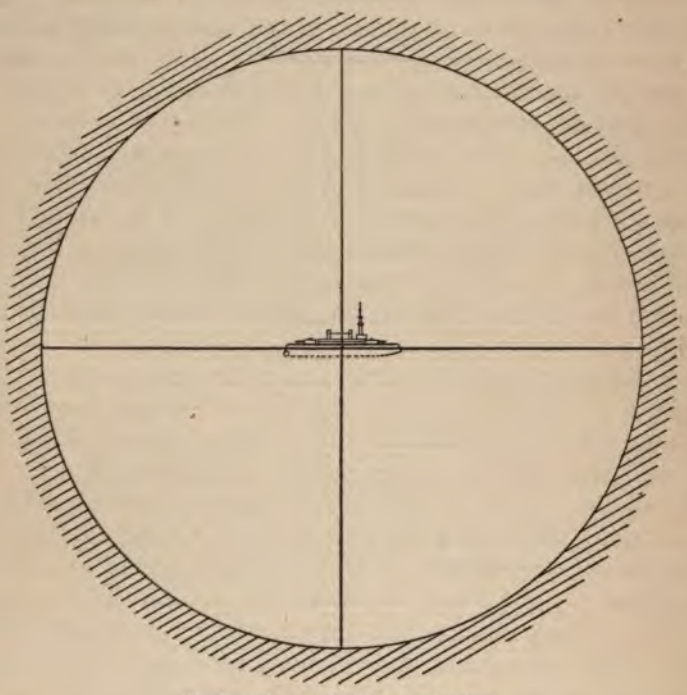
In the second place, even were it entirely practicable to use discriminating fire, as perhaps is the case when the range is 1000 yards or less, I think it can be shown to be generally injudicious. Not only would the rate of fire be diminished by the difficulty of pointing at a selected part, but unless that part were near the center of the target the percentage of hits would be materially reduced.

It may very well be that when firing at such a vessel as the Kearsarge, whose whole middle length is armored, it will be best to direct the small rapid-fire guns against the middle of the unarmored portions at bow and stern, since though the per-

centage of hits would undoubtedly be reduced, the percentage of effective hits might not be. With the larger rapid-fire guns, however, and, above all, with the armor-piercing guns, the middle body of the enemy's ship should always be aimed at, since the chance of hitting at all is then the greatest, and the natural errors of firing will distribute the hits just as effectually as would any attempt to do so by aiming special guns at special parts. Not only is the chance of doing damage with a heavy shell, wherever it may strike, too great to render it advisable to adopt a system which will reduce the number of hits, but the system referred to may often actually reduce the chance of hitting the parts specially selected for attack. Take, for example, the 13-inch turrets of the Indiana, each some 30 feet in diameter and 130 feet apart. A 13-inch gun aimed at the middle point between the two turrets would, in the hands of the average gun pointer, actually have a greater chance of hitting one than if it were aimed directly at either turret. How unwise, therefore, would it be to direct the heavy guns of a battle-ship specially against the turrets of an opponent. Until our practice is much better than at present, let them always be aimed at her middle length, with such allowance for speed as is thought proper, and not only will they make more hits on the enemy as a whole, but they will even make more hits on the enemy's turrets.

As for the question of the proper height at which to aim, this depends altogether upon the probability of hitting after ricochet. With the old smooth-bore guns it was undoubtedly best to aim at or even slightly below the water-line, because spherical shot ricochet with great regularity when the sea is comparatively smooth, and consequently a shot falling short had a good chance of hitting on the rebound, while one going over was wasted. With rifled guns, regularity of the ricochet can no longer be counted on; not only does the projectile deviate sharply to one side upon impact with the water, but unless the water is perfectly smooth it is impossible to count with any degree of certainty upon either the direction or the angle at which it will rise from the point of impact. Under these circumstances it seems to me to be best to aim slightly above the water-line. If every shot which fell short was lost, undoubtedly the best point to aim at would be the center of the freeboard, but since those which fall very little short may hit after ricocheting, the best results would seem to come from aiming a little above the water-line.

The drawing which I have here is an exact reproduction of what the gun pointer would see if he directed a telescope sight of our present pattern upon the Indiana at 2000 yards range. By imagining the picture of the ship to be moving rapidly up and down, and somewhat less rapidly to one side in the field, you can form an idea of the difficulty which would attend the attempt to select a special part to fire at.



Reduced one-half actual size.

The foregoing being the rules to be followed by the gun pointer, all instruction and drills should be with a view to instill them into his mind and to give him the ability to carry them into effect, and to this end the actual firing of the guns is not at all necessary. With the telescope sight and electric firing, a man can become a most expert gun pointer without firing a shot, and all that can be taught to the men by firing the guns is not to be disturbed by the noise and shock of the discharge of their own and neighboring pieces. But target practice has

another and far more important use than this. Its true end should be not to teach the individual gun pointers to shoot, but to teach the commanding officer and his subordinates to handle the ship and her battery as a whole, so that in the supreme moment of actual conflict she shall be a unity of intelligent co-operating parts. There is little or nothing to be gained by putting out a target at known distance in smooth water, leisurely steaming to and fro past it, firing one gun or one division at a time, carefully plotting the fall of the shot and awarding prizes to the men who make the best records. No, let the ship be cleared for action and handled as she would be in action. Let the methods of communication and of determining range which can best be used in action be learned; let the battery be used as a whole; let the ship be at the speed she would have in action, and let her be manœuvred as she would have to be in action. The reports of target practice frequently bear the remark, "Smoke interfered greatly with the firing." Let us learn how to manœuvre a ship so that the smoke will not interfere greatly, otherwise we may be seriously handicapped when we come to real fighting. I suppose that it may safely be said that hardly a ship in our service has ever had her whole battery in use at one time, and that hardly one commanding officer in our service has ever taken his battle station and handled his ship as he would have to in action. It seems to me that every target practice should be as exact a copy of an actual fight as possible, and that plotting the shot for the purpose of publishing the records of individual gun pointers is utterly unimportant in comparison with determining the best way to use the battery as a whole and teaching officers and men how to do it.

I appreciate the value of target firing to the gun pointers as affording a check upon their accuracy, and as lending interest to the otherwise tiresome business of working the guns. If a man has never had a chance to fire at a target at leisure, neither he nor his instructor will ever know whether he can actually do good shooting. But subcaliber practice has all the advantages of our present regular target practice, with the added one of being constantly possible and of little expense. The firing of the battery itself should be mainly a lesson in warfare, and only incidentally a lesson in shooting. Moreover, we devote too much time to unimportant accessories, teaching the men to perform

the manual of arms, march in company, handle a revolver or single-stick, and fire at a stationary target in smooth water. If each ship had ten years in which to be prepared for war, it might be well enough to have a long course of preliminary training before entering on the final stage of rehearsing an actual combat, but we never get beyond the preliminary stage. Let us have what is useful and indispensable first, and *then* the accessories, and even refinements, if there is time. Preparation for war should be our sole thought, the final end of our efforts, the center about which all else should turn. Above all, let us learn the lesson that nothing has any value as a matter of drill or exercise which does not lead directly to the realization of that supreme result—success in war.

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THE CAPABILITIES OF THE CHART COMPASS.

By G. Herrle, U. S. Hydrographic Office.

The notable improvement in the construction of the chart compass inaugurated within the last ten years in the United States, and since then also in other countries, suggests the idea to extend the usefulness of this device by showing how certain problems in navigation and in nautical astronomy can be solved by means of it quite readily within the limits of accuracy usually attainable in the measurement of a rhumb course or bearing.

It may be argued that, as the elements in nautical astronomy are required more closely than a course or bearing, and as there is already in existence a multiplicity of devices, tabular and graphic, intended to save computation and give results more or less accurate, any additional device for a similar purpose would be superfluous. For certain purposes, however, rough results are often sufficient, and in such cases, when other means are not at hand, a knowledge of the solutions by the compass would be of value; and further, it may be said that not a new device is involved, but simply new methods applied to an old device universally employed by mariners.

And possibly a knowledge of the fact that a number of problems can be worked out on the compass may, in the future, when these methods have become more generally known, lead to the adoption of at least one larger compass on coast charts, and may induce efforts to still further improve the construction of the compass by making the graduation of the ream more accurate than it now usually is.

The solutions given in this paper are based on the graphical translation of the well-known equation of the spherical triangle,

$$\cos c = \cos a \,.\, \cos b + \sin a \,.\, \sin b \,.\, \cos C, \qquad (1)$$

which, by the substitution of equivalents, may be made to read:

$$\cos c = \frac{\cos(a-b)+\cos(a+b)}{2} + \left[\frac{\cos(a-b)-\cos(a+b)}{2}\right] .\cos C \qquad (2)$$

In these equations a and b denote two of the sides, C the angle included between them, and c the third side of the spherical triangle. The translation will first be explained in detail, and later on rules deduced for the solution of the astronomical triangle.

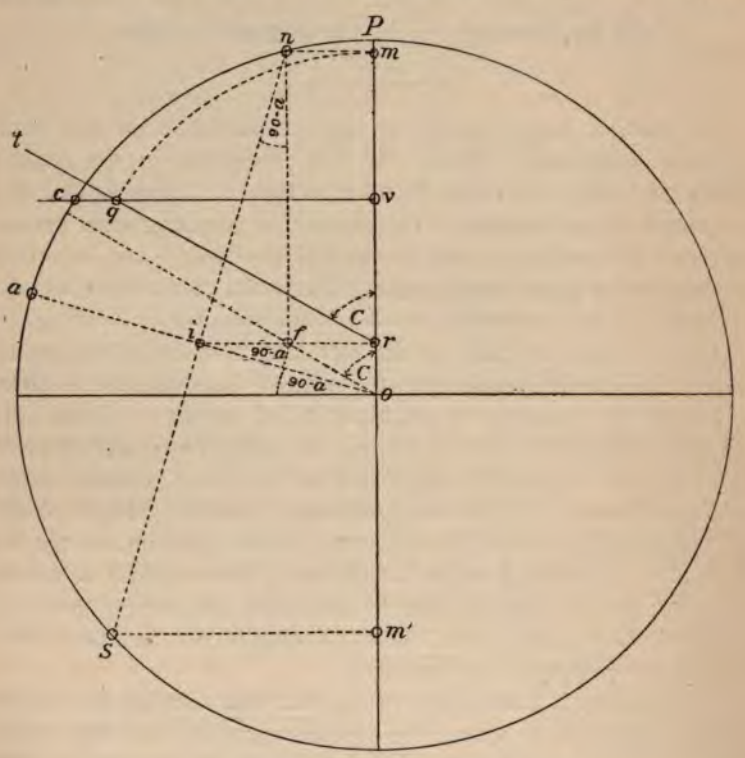

FIG. 1.

If on a circle (Fig. 1) the arc Pa is made equal to the side a of a given spherical triangle, and the side b is laid off from a to the northward and southward to the points n and s respectively, then nm and sm' drawn at right angles to the north and south line of the circle, and mm' divided into two equal parts at r, then:

$$om = \cos(a-b), \quad om' = -\cos(a+b),$$

$$\frac{om+om'}{2} = \frac{mm'}{2} = rm = rm' = \frac{\cos(a-b)-\cos(a+b)}{2}, \tag{3}$$

and

$$\frac{om-om'}{2} = ro = \frac{\cos(a-b)+\cos(a+b)}{2}, \tag{4}$$

which are the terms occurring in equation (2).

Or we may obtain the corresponding terms in equation (1) directly from the triangle *inf*, in which

$$in = \sin b, \quad \text{and angle } inf = 90° - a,$$

hence

$$nf = rm = \sin a \,.\, \sin b, \tag{5}$$

and from the triangle *oir*, in which

$$io = \cos b, \quad \text{and angle } ior = a,$$

hence

$$ro = \cos a \,.\, \cos b. \tag{6}$$

If we now lay off from r the line rt, making the angle C with rm, and with rm as a radius intersect rt at q, and through q draw a line at right angles to rm, then

$$\nu r = rm \,.\, \cos C,$$

and

$$o\nu = ro + \nu r = \cos a \,.\, \cos b + \sin a \,.\, \sin b \,.\, \cos C,$$

and as $o\nu$ is the cosine of the arc Pc, that arc is equal to the length of the third side c of the triangle.

Or, if the angle C were to be found, a, b and c being given, we first find r and radius rm, then lay off from P the arc $Pc = c$, draw the horizontal $c\nu$, and with rm as a radius intersect $c\nu$ at q, and measure the angle C included between the lines rm and rq.

The main operation then in the whole process consists in finding the position of the point r above or below the center of the circle, and the length of the radius rm; and as point r lies in the horizontal drawn through the point of intersection i of radius oa and of the line connecting points n and s, the elements ro and rm are always easily and quickly obtained. It will further be seen that ro and rm retain precisely the same values whether we first lay off from P arc a and then add arc b northward and southward, or whether we first lay off arc b and then add arc a northward and southward.

We will now utilize the process explained, in the solution of the

astronomical triangle, designating its different elements as follows:

L = latitude of observer,
δ = corrected declination,
h = true altitude,
λ = hour angle,
z = azimuth,
} of a heavenly body.

For convenience sake we will refer to the east and west line of the compass as the *equator*, to its north and south lines as the *meridian*, and to its north and south points as the *poles*.

Problem 1.—To find the azimuth (z), the latitude (L), the declination (δ) and the altitude (h) being given.

Solution.—On the ream of the compass mark L and δ in their proper places with reference to the equator; also mark on it h, counting the degrees from the equator *northward*; then take with the dividers the arc Ph (= the zenith distance) and lay it off from L northward and southward to the points D and S respectively; next find point i, which will be at the intersection of the line DS with the radius drawn to L. Through i draw a horizontal and mark point r on the meridian; also draw horizontals through δ, and D and S. From r as a center, and with half the vertical distance between D and S as a radius, intersect the horizontal through δ to the right of the meridian when the heavenly body is to the east, and to the left when it is to the west. Through the center of the compass draw a line parallel to that connecting r and the point of intersection on the horizontal through δ, and you will have the azimuth in the proper direction and amount as read on the compass.

Care must be taken in plotting the elements L, h, D and S at equal distances from the center of the compass, which is not difficult when the latter is provided with full line circles at the graduation, as in Fig. 2. Not all chart compasses, however, have these full line circles.

Ex. 1.—Given $L = 35°\ 30'$ N. and $h = 18°\ 36'$; find z when $\delta = 22°$ N. with the body to the west, and also find z when $\delta = 22°$ S. with the body to the east.

As seen in Fig. 2, z = N. 75° 3-4 W. approx. when the body is to the west in declination 22° north, and z = S. 43° 1-2 E. approx. when the body is to the east in declination 22° south.

Ex. 2.—Required the azimuth of Sirius (α Canis Majoris) to the east of the observer in latitude 24° 30′ S., the corrected altitude being 30° 20′. The declination of Sirius is —16° 32′, and the resulting azimuth is S. 84° 1-2 E. approx.

Fig. 3 compass being from an English chart, the magnetic meridian is used in solving this example in place of the true meridian, and the azimuth S. 84° 1-2 E. is of course the true and not the magnetic azimuth.

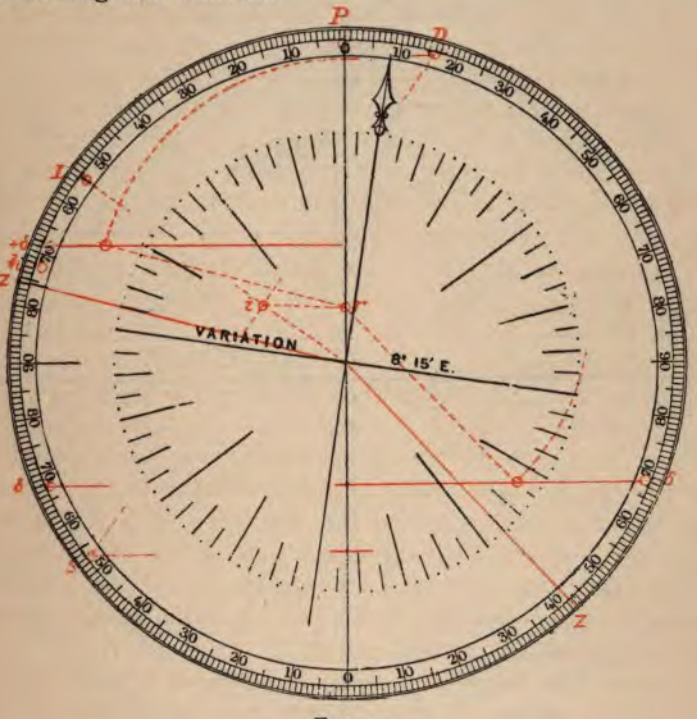

FIG. 2.

This example incidentally shows that for the solution by compass the U. S. chart compass is superior to the English, as by the former the true and magnetic azimuth can be immediately read off.

Problem 2.—To find the amplitude of a heavenly body at rising or setting, L and δ being known.

Solution.—This is merely a particular case of Problem 1, h being zero, hence D and S are distant 90° from L northward and

southward and point r falls on the center of the compass. Half the vertical distance between D and S is equal to the horizontal distance between point L and the meridian, therefore all that is needed is to take this distance with the dividers and to intersect with it from the center of the compass the horizontal through δ. The connecting line between this point of intersection and the

FIG. 3.

center of compass will show the true amplitude A, which will be north when δ is north and south when δ is south.

Example.—Find the amplitude of the sun at setting in latitude 45° 1-2 N., the declination being 13° 20′ S. The resulting amplitude (see Fig. 4) is W. 19° 1-4 S. approx.

Problem 3.—To find the hour angle (λ), L, δ and h being given.

On account of the small size of chart compasses the hour angle cannot be read off with sufficient accuracy to make the solution by compass of much practical use, and the problem is included in this paper merely to show how it could be solved more accurately on a graduated circle of larger diameter.

Solution.—The hour angle in arc is found by a process identical with that for finding the azimuth from L, δ and h, with this

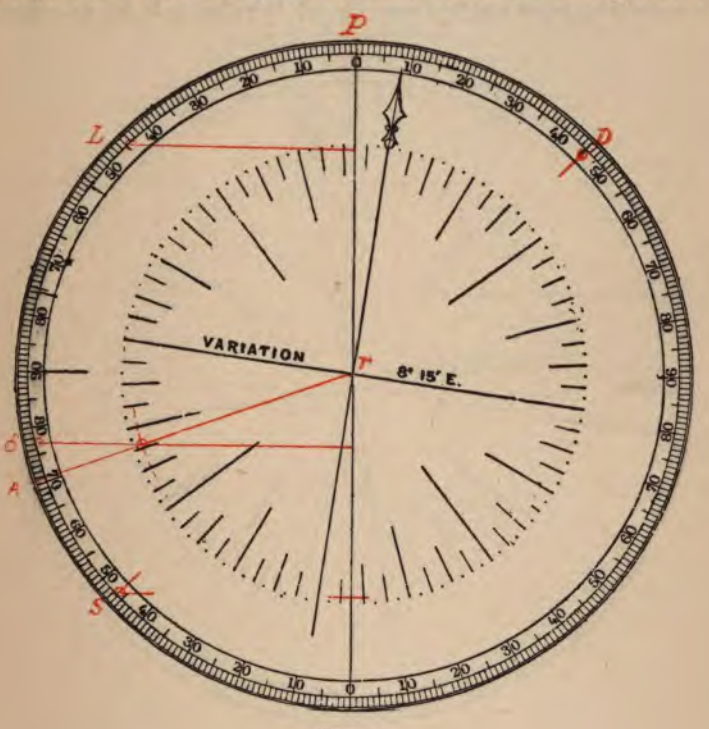

FIG. 4.

difference, that instead of laying off the arc Ph (the zenith distance) from L, the arc $P\delta$ (the polar distance) is laid off northward and southward from L to D and S respectively; and instead of intersecting the horizontal through δ with half the vertical distance between D and S, the horizontal through h is intersected with that distance. The hour angle is always to be counted from the north pole. (Care must be taken to lay off D and S exactly,

which can easily be tested, as one is equal to the difference and the other to the sum of L and δ, as read on the compass.)

Ex. 1.—Find λ when $L=65°$ N., $\delta=22°$ N. and $h=15°$ 3-4, the body being to the west.

As seen from Fig. 5, the resulting compass reading of λ is S. 80° W., which, counted from the north pole, corresponds to an arc of $100°=6$ h. 40 m.

Ex. 2.—Find λ when $L=12°$ S., $\delta=6°$ N. and $h=18°$ 06′. The resulting hour angle (see Fig. 6) is $70°=4$ h. 40 m. approx.

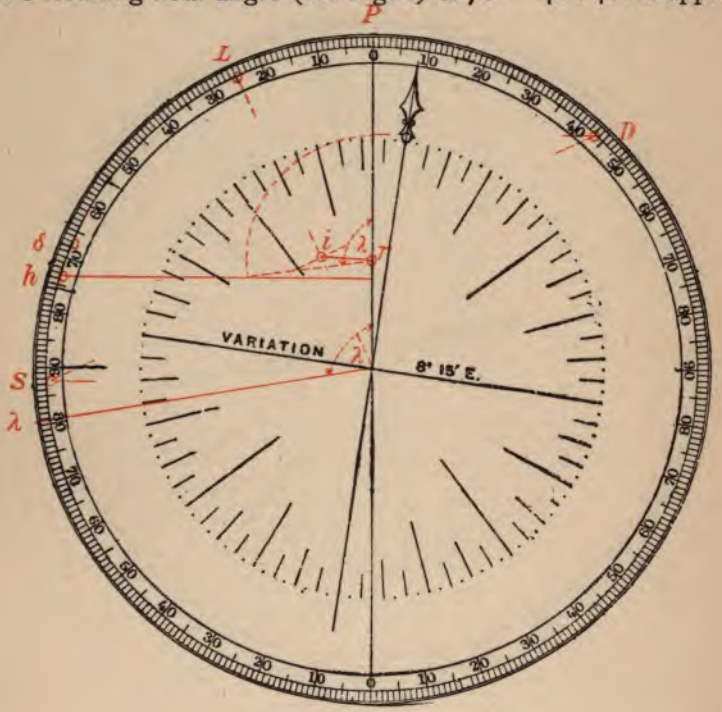

FIG. 5.

Problem 4.—To find the hour angle (λ) of a heavenly body at rising or setting, L and δ being known.

Solution.—This is a particular case of Problem 3, h being zero. Hence after finding D and S and point r as in the preceding problem, intersect the equator with half the vertical distance between D and S, and through center of compass draw a line parallel to that connecting r and the point of intersection at the equator. Thus,

if in Example 2 of the preceding problem we make $h=0°$, the resulting hour angle λ would be 88° 3-4 = 5 h. 55 m. approx.

Any one who has arrived at an understanding of the processes with the compass will find no difficulty in applying them to various other problems involving the determination of a side of the astronomical triangle, and there appears to be no need of enlarging further upon the subject beyond showing how to measure on a compass-rose the great circle distance and course

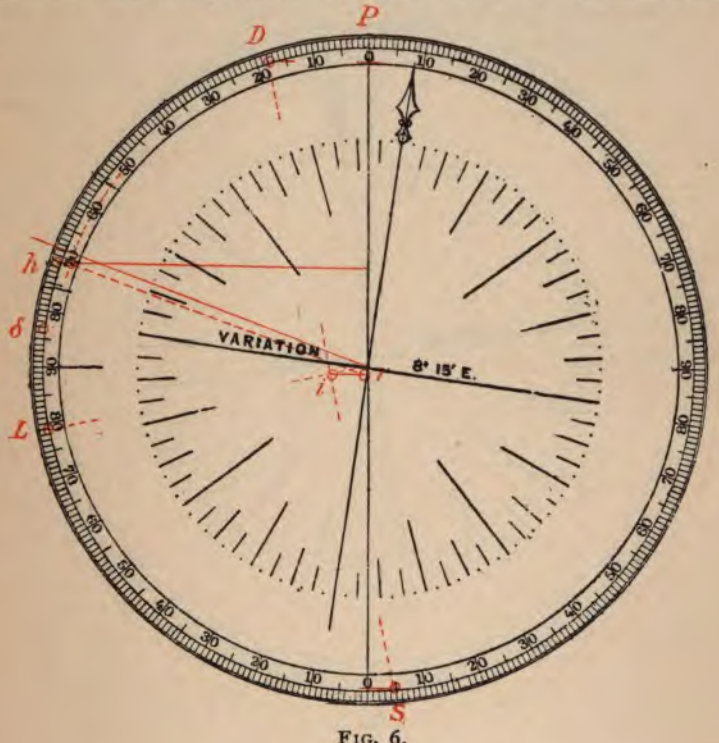

FIG. 6.

from one place to another on the surface of the earth, a problem the solution of which is identical with that of finding altitude and azimuth from latitude, declination and hour angle.

Problem 5.—To measure the great circle distance and course from a point off the Cape of Good Hope in lat. 34° 25′ S., long. 18° 30′ E., to a point at the entrance into Chesapeake Bay in lat. 37° N., long. 75° 57′ W.

Solution.—Designating the latitude of the point of departure by L' and that of the point of destination by L'', mark L' and L'' on the ream of the compass (Fig. 7), then lay off the arc PL'' from L' northward and southward to D and S, and find points i and r as in the preceding problems. From r lay off a line making with the meridian an angle corresponding to the difference of longitude between L' and L'' ($94° 27' = \lambda$) counting the degrees from the north pole, and intersecting this line with

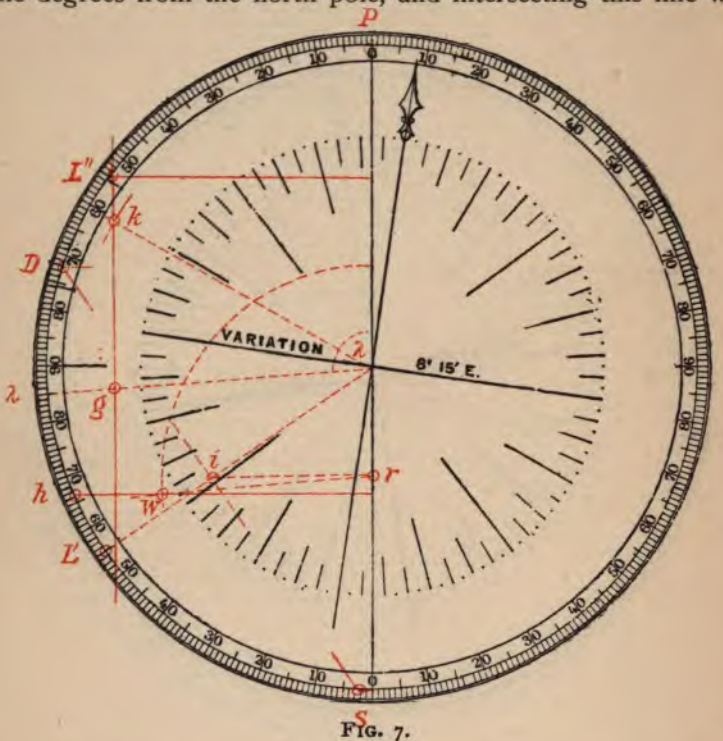

FIG. 7.

half the vertical distance between D and S (at w). Through w draw a horizontal and read the latter's intersection on the ream of the compass (at h), which, counting from the north pole, will show the required distance, in this case about 113° or 6780 nautical miles. The course is now obtained like the azimuth in Problem 1, or when not too near 90°, more conveniently, as follows: On the radius to λ lay off the horizontal distance between L'' and the meridian, this will give point g; through the

latter draw a vertical and intersect it from the center of the compass with the horizontal distance between *h* and meridian at *k*. The radius through *k* will show the course required, in this example 60° very nearly.

The solution of the examples given shows what can be accomplished with so simple a means as a chart compass, and it is surprising how good results can be obtained, as any one may ascertain from trial, if the compass is accurately constructed and provided with a full line ream so as to facilitate the correct marking of the several elements, and if a sharp-pointed pencil and good dividers are employed.

DISCUSSION.

TORPEDO-BOAT POLICY. (*Continued from page 67.*)

Assistant Naval Constructor H. G. GILLMOR, U. S. Navy.—The author recognizes two uses of torpedo-boats. Is the same kind of boat, that is, one with the same features of speed, armament and coal capacity, best adapted to these two purposes? Is it the custom to embody in the design of coast defense vessels the same features in the same proportions that they are embodied in the cruising battle-ship? Are not the relative values of the different features in torpedo-boats which are to form a part of the coast defenses essentially different for those in torpedo-boats which are for service with the offensive arm—the cruising navy? May not the relative values of the features of a torpedo-boat of the coast defense depend upon the peculiarities of the locality in which it is intended to act?

It is to be feared that the purpose of torpedo-boats, "to destroy the enemy's ships," has, in some cases at any rate, been lost sight of, efforts being directed to the production of "the fastest boat of her size in the world" or "the fastest vessel afloat." The necessity for surprise has certainly been lost sight of in a great many cases.

It is not the intention to commence here the contention regarding the introduction of the ram, but it would seem that the proposition to make a ram of a vessel whose ratio of length to beam is ten to one and whose difficulties of local weakness are so great is ill-advised. Upon the weight allotted by the author—and it is very doubtful if it would be sufficient for the purpose—an additional 3-pounder and about a hundred rounds of ammunition could be installed, and the chances of a disabling shot from it would be considerably greater than the chances of ramming, even could that be attempted with reasonable safety to the ramming vessel.

The case cited of the Audacieux and the Chevalier should prove instructive. The angle belt of steel with a wood backing which the author speaks of was a wood chafing batten about 3 inches square, secured to the sides of the boat with two light angles, the whole being intended as a protection when lying alongside a landing or a ship. That so light a protection should have produced such disastrous results to the rammer may be taken as an index of the amount of local strengthening necessary to make ramming possible with reasonable safety.

The author has laid great strees upon the question of endurance. The method which he adopts in making comparisons of maximum power is extremely misleading and affords a very poor measure of the relative endurance of boats of different types, because of the very great variation in the maximum horse-power among them. There is usually no relation at all between full speed endurance and economical endurance in two boats unless they have exactly the same speed features. That the maximum power will only be used for short spurts and that the long distance work will be done at the economical speed is pretty well conceded.

What, then, is the justice of a comparison of a 5½ hours endurance at full speed of a thirty-knot boat with the 17 hours endurance at full speed of a twenty-six-knot boat of about the same size, when the endurance of the first at cruising speed is about one-half that of the second, instead of about one-third, as a comparison on the full-power basis would show? The column in the tables devoted to pounds per I. H. P. at the maximum power is equally misleading. The coal consumption trials of the Ardent and the Starfish, the results of which were published in *Engineering* some time ago, showed that at thirteen knots, the assumed economical speed at which the trial took place, the Ardent would steam 28½ nautical miles per ton of coal, her full capacity giving her, therefore, an endurance of 2000 nautical miles; and the Starfish would steam 39.6 nautical miles per ton of coal, so that her full capacity would give her an endurance of 2360 nautical miles. M. Normand, in his article before the Association Technique Maritime last year, gives the results of the coal consumption trials of the Forban at ten knots, her economical speed, and from these results the endurance of the Forban at ten knots would be about 2360 nautical miles. This would tend to show that in the matter of endurance size does not possess so great an advantage as might at first sight appear.

The speciousness of the author's argument in the comparison of a 22½-knot boat with a 30-knot boat will be evident by applying it successively to boats differing in speeds by successive equal amounts down to the speed of 12 knots which he assumes as the speed to be used prior to discovery. It is to be noted that this speed of 12 knots assumed by the author as the advisable speed prior to discovery is entirely arbitrary. It is obvious that the speed at which flaming at the funnels and surface disturbance begin to appear to an extent endangering the secrecy must depend upon the approach to maximum power and speed, and while it might be 12 knots in one boat, it might be 20 in another. This in itself would vitiate the comparison between the 22½-knot boat and the 30-knot boat, were it otherwise logical and consistent.

The author has made much of the maintenance of speed in a seaway. Just what are the differences between the performances of a torpedo-boat of one hundred tons and a destroyer of two hundred tons in a seaway and in still water has never been determined. It is conceivable that the conditions of sea most unfavorable to the destroyer might be very much less so to a boat of one-half its displacement and two-thirds its length; just as with ships in squadron it is sometimes found that seas most unfavorable to the larger ships have comparatively little effect upon the smaller. In any event, the difference in the performance of the two must be affected through difference in freeboard and the effect of dead weight in maintaining speed in a seaway. Then, too, there is always the question whether, in circumstances of weather seriously affecting the speed, the larger vessel would be in a postion to attack and destroy the smaller.

A careful perusal of all that precedes the author's conclusion as to "the best type of torpedo-boat" fails to bring the conviction beyond question that a boat of one hundred and fifty feet length and one hundred and twenty tons "would fill all the requirements." Even if it would fill all the requirements, is it the boat which would *best* fill all the requirements?

Should we have the same boat for both offensive and defensive purposes—the same for the defense of New York, service in the Chesapeake Bay and with the fleet?

That size need not be governed by conditions of seaworthiness, within the limits of size under our consideration, has been demonstrated practically and effectively by the experiences during the past ten years of torpedo-boats varying in size from one hundred feet and forty tons upward, which have not only successfully weathered gales of great severity, but have made voyages of several thousands of miles in varieties of weather at fairly constant cruising speeds. The Batoum, the Brazilian and her two sister boats, Torpedo-boats No. 62 and No. 63 of the British Navy, boats for Japan, for China, for the Victorian Government, for India and for several of the South American States have long since exposed the baselessness of the charge of unseaworthiness on the ground of size. The possibility of seaworthiness independent of size being established, it is evident that life is no less possible to men habituated to a small torpedo-boat than to the thousands of men who yearly leave this coast and the coasts of other countries for service covering months at sea in fishing vessels whose sizes and the violence of whose motions are not greatly different from torpedo-boats, however greatly they may differ from these boats in proportions and characteristics; and that therefore this need not be taken as placing a limitation upon the size of torpedo-boats. In this connection let the remarks of Captain Eardley-Wilmot, quoted by the author on page 15, be reread. Why then "pass at once to twice the displacement at least"? Does the increase in endurance and armament necessitate this sudden doubling of displacement? Is the increase in first cost, maintenance, the number of men involved in each engagement and the loss in invisibility worth the cost?

The history of English torpedo-boat construction, from its commencement to the present (and a definite policy is not yet established) is a history of keen competition for the highest speed among a limited number of builders. There has never been a time when any type produced has been carefully and systematically tested, after training crews to the peculiar life required by the service, to determine the fitness of the type for the designed purpose, and what, if any, changes might with advantage be made. The development and its course have been determined primarily and preëminently by the rivalry of a few builders of high-speed boats, each seeking to excel the speed performance of the other, regardless of economy of power; and secondarily and partially by yearly haphazard expressions of opinion by officers high in rank, based upon a week's or at most a fortnight's observation from a distance of torpedo-boats hastily commissioned, usually with raw crews and officers new to the special service, working in one kind of weather, on one portion of the coast, under wholly arbitrary rules governing their performance. They have produced boats increasing constantly in size, displacement and speed. The end has not been reached, and speeds of 32 and 33 knots are talked of.

The "torpedo-boat destroyer" is, for the present only, the last term in the ascending series of torpedo-boats. It is the logical result of the causes which have determined the course of English torpedo-boat con-

struction. Any points of superiority—and it must be admitted that there are some—which it possesses over the earlier members in the series, aside from speed, are incidental to and made possible by the increase in size which, to the English professional mind, is inseparable from increased speed; and not the prime objects sought in the design. It is speed that has ever been the will-o'-the-wisp luring on English torpedo-boat builders. What has been this "several years' experience with the type" which makes it appear "that they are just what is required for general use with the fleet"? Each in turn has come from the builder with column notices in the daily papers, to enjoy for a few days or a few weeks the distinction of being the "fastest boat in the world" or "of her class," and then be commissioned and go to serve with the fleet under peace conditions as one of the cruising fleet, with no more effort to determine her fitness for her definite purpose than was the case with her many predecessors. One year it is a boat of one hundred and ninety feet and 27 to 28 knots that is "just the thing," the next a boat of 200 or 210 feet and 30 knots, and the next a boat of 220 feet and 31 or 32 knots. Is there any reason to believe that the end has been reached, or that five years hence the same treatment of the subject will not demonstrate equally conclusively that "just the thing" is a boat of 350 tons and 39 or 40 knots?

It is to be feared that the key to the author's conclusions is to be found in this question which the author propounds in his introduction—"Which of these different types shall we copy after for the present?"—rather than in the incomplete reasoning which precedes them. Expressed in a few words, the author's conclusion is that we should start in this mad race for torpedo-boat speed about where England now is and accept their latest type in one case, and in the other almost a duplicate of the last thing which the English newspapers chose to call a torpedo-boat.

With regard to coal protection, all that may be said is that if the coal is in the bunkers at the time, and the striking energy is less than sufficient for the penetration of ¼ inch of steel and 2 feet 6 inches to 3 feet of loose coal, the boat may be saved an occasional shot. It is, however, to be remembered that coal is carried for use and not for protection and may, probably will not, be there when needed and that the top coal of the bunkers is the first used.

It would seem that the decrease in probability of complete disablement by separation of the two engines in compartments longitudinally is considerably overestimated. It is to be remembered that in such a separation the vital target is considerably increased, for in boats like No. 6 and No. 7, injury of the high pressure cylinder, valve chest or the steam supply pipe of either engine would result in the disablement of both on account of the loss of pressure through the opening so made. In the boats designed by the Navy Department, means are provided for closing the stop-valves of either engine from the deck, but even with this arrangement there would be an interval during which both engines would be disabled. When we consider that the chances of such a hit being made are practically doubled by the arrangement suggested, whatever arguments there may be for the arrangement on the ground of increased convenience

or better distribution of weight, there can be none on the ground of increased immunity from disablement.

Lieutenant A. P. NIBLACK, U. S. Navy.—In no country in the world do the technically informed officers control the questions of types of ships and the shipbuilding policy. These are largely determined by political, financial, and commercial considerations. Nevertheless, it is of great interest to know what we ought to hope for, and no one is better qualified, in a way, than the essayist to set us straight in the matter of torpedo-boats. As an observer and in no sense technically informed, I must express my regret that in the limits of the essay so much was left unsaid which it appears to me ought to be considered under the title "Torpedo-boat Policy."

Both the navy and the shipbuilding firms in the United States have figuratively "cut their teeth" on a heterogeneous lot of steel cruisers, and at present the result is: 1st. Our new battle-ships of the Alabama class are about as nearly ideal for our purposes as human ingenuity can devise; 2nd. In the monitor type we have the highest development of inner coast line and harbor defense ships, and 3rd. When we resume building cruisers, we can, and doubtless will, so profit by the past and by results abroad as to assure the adoption of a type suited to our particular needs. It appears that in the torpedo-boat question we must also go through the teething period. Certainly the present programme is indefensible from a technical standpoint, however necessary and wise from a commercial or financial point of view.

It is a pity we cannot inaugurate at once what we, as a sensible, practical, thinking people, must ultimately come to in torpedo-boats, as we have in battle-ships and monitors (and ultimately will in cruisers), viz. torpedo-boats must suit tactics and policy, and designs must not vary at the whim of boards, designers, or contractors. The important thing is not that each ship or each torpedo-boat must be the latest thing in every detail, but that the fleet shall be homogeneous.

Effective torpedo-boat service can only be organized, carried on in time of peace and operated in time of war by boats manœuvring in company with a fixed system of tactics and with a perfect similarity in type. We have set an example to the world in common sense by limiting the speed of battle-ships to 16 knots: why not stop the equally indefensible high speed for torpedo-boats? The essayist shows conclusively its folly, but fails to drive home the real conclusion. Let us set the limit of speed for the 250 to 300-ton boats at 26 knots—good, honest, reliable *sea* speed without any question. Let us limit the first-class boats at 24 knots. This illusive and always increasing variable once fixed we may grasp the substance and not the shadow.

The true policy is to build torpedo-boats in groups either at the same time or from year to year, each group having identical tactical and manœuvring qualities, interchangeable parts, and being as nearly alike as possible.

The tests applied to the torpedo-boats of the world, which the essayist

passes in review, is illusive because he fails to appreciate the wonderful system of Germany, which country has grasped the fundamental principles thoroughly. Their system is to build boats in groups, roughly, one division boat corresponding to an English "destroyer," and seven or eight first-class boats. Six torpedo-boats and one division boat form the group unit, with one or two first-class boats in reserve to keep the number up to six. The division or "mother" boat carries spare parts for the group and is practically flag-ship. All boats have single screws, and manœuvring qualities are easily obtained by a bow rudder in addition to the one astern. A flock of swallows could not manœuvre more adroitly at close distance than do the German boats.

In our country, manœuvring in groups from fixed bases, laying up in groups, scouting in groups, accompanying squadrons in groups are as clearly the real policy as for Germany. This building of individual ships and of torpedo-boats to break records and advertise particular shipbuilding firms is a great thing commercially, but not from a military standpoint. Speed costs tremendously. Four torpedo-boats that we really want, for the same money that three cost of a type we don't want, is a proposition to be commended to those who have the spending of the money. Why not use good, hard common sense and stop this folly now, instead of waiting two or three years? We don't buy race-horses for the cavalry. Of all sciences, cavalry tactics imposes definite conclusions, and so does torpedo-boat tactics, if we will only think about it.

I am not so sure that twin screws are essential, although they are a great comfort. As for strengthening the bows for ramming, I rather think that for group manœuvring the continual danger to consorts is not worth its offensive advantage in the remote chance of ramming an enemy's torpedo-boat. It would seem to me better policy to make the bow light and to give armor protection amidships at the water line, especially in view of the increased penetration and rapidity of fire of modern small arms and machine guns. Coal endurance, reliable sea speed, and seaworthiness are the benefits we may look for in reducing the speed.

I think the essayist has either somewhat lost sight of the tactical side or else does not believe in its efficiency. He is quite right in saying that the Austrian Viper does not handle well because she has only one screw; but the Natter, built by Schichau in competition with the Viper, has only one screw also, but by means of a forward rudder she handles splendidly. After all, six torpedo-boats of inferior speed and older type, but all identical, are worth more than six faster ones of heterogeneous types, unless tactics is a dream of theorists.

The Composition of the Fleet.

[See No. 79.]

Lieut. J. M. Ellicott, U. S. Navy.—I presented my essay on the composition of the fleet under a conviction that the time had come when not one, but many, even all, officers of the Navy ought to give their views upon the number and types of vessels which should make up our naval establishment; hoping that from the presentation of such views there might be deduced a sufficient consensus of opinion to command the attention of our legislators in framing and maintaining a building program. My views, as those of an individual, I presented briefly, trusting that others would round out the subject by discussion. As it has been impossible to reach more than a small percentage of officers with advanced copies, and as these were distributed in the summer season when the mind seeks relaxation and rest, I hoped that my essay may yet "draw more fire." I am gratified to find that my views are so little at variance with a majority of those expressed in the discussion, and I beg room in the pages of the Proceedings of the Institute for some words to those who seriously differ from me.

Lieut.-Commander Wainwright seems willing to allow the building up of our navy to be determined by "the opinions of our legislators for the time being." Those opinions are happily trending in the right direction at present, but such haphazard building will not give us a homogeneous fleet, nor keep it up to any constant standard of efficiency. He also advocates basing our program upon the "present needs of the country," in which case we will always be at least five years behind our needs, for a battle-ship takes five years from appropriation to completion. When it is remembered that we are a child among nations, growing at an enormous rate, and in a time when international relations around us are strained, almost to breaking, and enterprises are projected over which we should, for our welfare, exercise paramount control, it must be conceded that we have *got* to speculate to a certain extent upon future requirements in order to keep abreast of the needs of the country.

Lieut.-Commander Wainwright states that "the most expensive way of mounting guns, when due weight is given to their proportional effectiveness, is on monitors." I regret that I cannot now get figures upon the subject, but I say without hesitation that I believe this statement can be proven to be wholly and vastly wrong. We now have guns of the same calibres and latest construction mounted both ashore and upon monitors. Mr. Wainwright is in a position to get full information of the expense in each case, and I beg that he will look it up and state it.

Does Lieut.-Commander Wainwright believe that we will ever have "adequate fixed defenses"? Does any military or naval man fully believe it? I think not. On the contrary, I believe we all know that we never shall. "Adequate fixed defenses" for New York City will include heavy modern batteries at Sandy Hook, Romer Shoal, Forts Hamilton and Wadsworth, Governor's Island, Willet's Point, Fisher's Island, Plum Island, and Little Gull Island. A few of these we have, and all are projected, but there is not a shadow of a chance of the scheme being com-

pleted within fifty years. Had we not better put such batteries on ten monitors in the meantime, ready to be mobilized in time of war wherever in this district they are needed?

I believe that the views expressed by Lieut.-Commander Wainwright, Commander Goodrich and others against commerce destroying are more sentimental than military. It is looked upon as the resort of a weakling among nations because the most apparent damage is to the commercially strong. Moreover, its effect upon the conduct of a war is indirect and not easily measured, and it has never been systematically projected and maintained by a nation strong enough to do so. The demands of trade control the actions of nations more and more every day. The nation which first compels the voice of trade in the other to cry out against a war will have won half the fight. Supposing a nation at war with Great Britain; would it not be looked upon as folly if the former allowed the latter's thirteen million tons of shipping to sail the seas unmolested?

I do not think that my statement about army scouts will suggest to any one who carefully reads the paragraph that I confuse army scouts and spies, but my suggestion that scout vessels "should be modeled so closely after ocean coastwise passenger steamers as to be readily mistaken for them" does place them more in the category of spies than scouts. I am ready to concede that they might, therefore, be designated "spy vessels," yet I think that we would prefer to call them scouts and leave the enemy to use the other designation. Whatever we call them, I reiterate my belief in their importance.

I cannot admit that I have failed to grasp the true use of the armored cruiser, but I overlooked the important use for her which Lieut.-Commander Wainwright well states, and which might briefly be called reconnoissance in force. When she returns upon the fleet from such reconnoissance, however, she is bound to find her place in the line of battle very much as I have suggested. I advocated the New York in ignorance of her many developed shortcomings. After much discussion at the War College last summer a preponderating opinion developed that the Olympia, with 1500 to 2000 tons more given to protection, making her about 7500 tons displacement, would make a good type. Lieut.-Commander Wainwright says "the necessary qualities have been obtained in other countries by building vessels of less than 7000 tons." If he will name the vessels he has in mind and state their offensive and defensive qualities in further discussion, his information will, I know, be read with the deepest attention and interest.

Lieut.-Commander Wainwright is correct about the necessity of improving some of our canals and interior waterways for torpedo-boat navigation. Let us insist that this be done and not "be satisfied with inferior boats."

I challenge the statement that "a portion of the public view the navy with suspicion and suggest ambitious motives," and that my paper gives cause for such suspicion. What possible ambition can we have except to see our magnificent country sufficiently armed to be unassailable by inferiors, and to have no superiors; to assert a dignity, an independence and a control in the Western World with the confidence of being able to maintain them; and to insure the continued advancement and civilizing

influences of republican institutions. Increase in our naval establishment can only mean to individual officers more arduous and continual duty afloat. The view Lieut.-Commander Wainwright takes sounds medieval.

Lieut.-Commander Wainwright condemns my "ambitious program," but let it be noted that he says "we need more battle-ships, more armored cruisers and many more torpedo-boats," and I hope that these statements, coming from him, *will* have "very serious weight with those who have the shaping of our naval shipbuilding policy."

To a great majority of readers the language with which Commander Goodrich opens his discussion must seem so harsh as to discount the value of his criticism. He even impeaches the judgment of the Board of Control of the Institute in awarding the essay honorable mention. It was at my written request that Commander Goodrich's discussion was solicited by the Institute, and I made the request because I knew that his views were radically different from mine. I fully understand, therefore, that his harsh words are due to the very positive opinions he holds upon the subject of the essay.

He first asserts that there is no evidence that "we are in daily jeopardy of national humiliation," etc., because of our small navy. Is there a legislator or a military man, is there a thinking man in our whole country who has not felt more or less misgiving within the past year about our being able to maintain our loudly proclaimed attitude in the Venezuela boundary dispute? Was there a naval man who did not realize the jeopardy of humiliation in the matter about a year ago when England called into being, without drawing from her cruising fleet, a flying squadron superior to our whole navy, and dispatched it—Heaven only knew where, during the white heat of the controversy? Does any American believe that any other power would have been so tolerant and calmly argumentative as England has been in the matter? Does not all Europe stand aghast to-day at the position England has accorded to us in the control of the affairs of our American neighbors?—the Continental press declaring that European states cannot abide by it.

As evidence of our daily jeopardy of national humiliation because of an insufficient navy I beg leave to cite the following occasions:

1. In 1795, when we felt compelled to pay one million dollars in tribute and sign a treaty guaranteeing $22,000 annually to Algiers to spare our commerce because we had not a navy sufficient for its protection.

2. The impressment of American seamen by the British, culminating in the wanton capture of the Chesapeake by the Leopard in a time of profound peace (1807), when we could do nothing for redress but issue a proclamation prohibiting British warships from entering our ports.

3. The drawn fight of 1812, when we felt compelled to accept terms of peace without adjustment of the cause for which we fought, because, despite the brilliant victories of our seamen, we had not ships enough to cope with the enemy, and ships could not be built in a day.

4. The wholesale shooting in Santiago de Cuba of American citizens taken on board the Virginius in 1873, after a summary and farcical court-

martial in direct violation of our treaty with Spain. This massacre was only checked by the arrival of a *British* war vessel, and, in spite of our strenuous efforts to galvanize our decaying naval hulks into a semblance of life and strength in a demonstration at Key West, it is doubtful if we would have gotten the partial reparation we did had not Great Britain's claim been the same as ours.

5. The hunting down and killing, in the streets of Valparaiso, of sailors from a United States man-of-war in 1891, and Chile's insolent attitude in the matter, which was unquestionably born of her belief in our naval inferiority.

Commander Goodrich says "Mr. Ellicott's plan rests upon a policy which he thinks the nation should adopt." On the contrary it rests upon a policy which the nation *has* adopted, and which is no departure from the teachings of Washington, but the amplification of those teachings commensurate with our national growth. No man realized the value of a naval force more than did Washington, and, when President, he was continually urging upon Congress the importance of building up a navy. These are some of his "teachings" in his own words, and one statement I take the liberty of italicizing:—"To an active, external commerce the protection of a naval force is indispensable." "Will it not be advisable to begin without delay to provide and lay up the materials for the building and equipping of ships of war, and to provide in the work by degrees in proportion as our resources shall render it practicable?" "*To secure respect to a neutral flag requires a naval force organized and ready to vindicate it from insult or aggression.*"

I confess that I am utterly unable to comprehend Commander Goodrich's fine distinction between coast and harbor defense. When our mobile fleet goes to sea to meet the enemy it is defending our harbors and thereby our coast. It is the multitude of our harbors and their wide distribution along a continuous coast line which renders us so vulnerable. We cannot tell where the blow will fall. Our fleet of battle-ships, be it eight or twenty strong, may, and probably will, be eluded, and a blow struck at a harbor for a base or ransom. We must have some harbor defense in addition to the fleet at sea to ward off such a blow until our fleet regains touch. Fortifications will not accomplish this; their immobility would require them to be too numerous. A monitor fleet would accomplish the purpose. It is mobile; its units able to support each other; its guns never out of range and never masked. This is not localizing our defense and scattering our forces, abandoning strategy and surrendering the command of our water approaches, as Commander Goodrich tells the Institute readers I have proposed.

"Our great contingent power" cannot be mobilized, cannot be materialized when a catastrophe is imminent. At best it brings us scanty apology and inadequate reparation for insult offered and injury done. Few statesmen will have the temerity to rely upon it. We need an actual, material, mobilized naval force which will enable us not only to assert but to maintain our national policy, and which, instead of assisting us to collect damages for injuries done, will make it impossible for such injuries

to be committed. If we fear that such a naval force would be a menace to our democratic principles we have not sufficient confidence in ourselves to develop a strong national character. We must not be content to provide a future naval force "based upon the present needs of the country," nor to rely upon "our great contingent power." Washington said, "To secure respect to a neutral flag requires a naval force *organized and ready* to vindicate it from insult or aggression."

PROFESSIONAL NOTES.

COMPRESSED AIR SYSTEM ON THE U. S. MONITOR TERROR.

The use of compressed air as a motive power on board a war-ship presents several advantages over steam or hydraulic power, which render it a powerful competitor. As compared with steam, it is less dangerous, especially during an action, when a broken steam pipe might prove terribly fatal, and it enables certain parts of the ship to be kept at an even temperature, which would otherwise be rendered uncomfortably hot by the presence of steam piping. Steam and hydraulic engines, moreover, require exhaust pipes discharging outside the hull of the ship; whereas the exhaust from the pneumatic cylinders may be turned into the ship or into the outside air, as may be most convenient. There are certain localities in a ship where the exhaust from a pneumatic engine would prove a valuable source of ventilation, as, for instance, in a turret crowded with men and machinery, or in the close confinement of a steering room situated below the protective deck. As compared with hydraulic power, the compressed air system is cleaner and more convenient, and free from the discomfort that arises from the leaking of hydraulic pipes and cylinders. There is immunity from freezing. Leakage is not attended with increase of temperature, as with steam; or flooding of the compartment, as with the hydraulic system. There is less danger of break-downs when starting up or stopping motors suddenly than in the other systems.

The U. S. Monitor Terror is the first vessel to be equipped with pneumatic steering engines and pneumatic operation of turrets. The recent tests were highly satisfactory.

The air for driving the various pneumatic devices is compressed by two separate engines, one being placed in the hold near the forward turret and the other near the after turret on the berth deck. The working pressure is 125 pounds per square inch, and there is no reservoir for the air except an eight-inch pipe, which runs through the vessel and supplies the two turrets and also the steering device in the steering room at the extreme after end of the ship. These two engines supply sufficient air for turning the turrets, elevating the guns, lifting the ammunition into the cages, raising the cages to the breech of the gun, ramming home the charge, closing the breech, checking the recoil, and lastly, and most important operation of all, steering the ship itself.

The two turning engines are placed upon the floor of the turret, one on each side of the big guns. Each engine has two cylinders, 8 inches in diameter by 14 inches stroke. A worm on the crank shaft operates a set of gears by which the power is multiplied many times over before it reaches a driving pinion, which, in common with the engine and gears, is firmly bolted to the framing of the turret and of course turns with it.

The pinion meshes with a large circular rack which is bolted to the deck of the ship and lies immediately within the circular steel track upon which the turret rotates. The engines are controlled by suitable levers and hand wheels situated within easy reach of the officer in the sighting hood, the latter being placed over and between the guns.

The elevation and depression of the gun is effected by means of a massive ram, which is hinged to the floor of the turret and bears against a shoe on the under side of the gun carriage near the breech of the gun. On each side of the turret is a cylinder containing glycerine and water, a portion of which, when the gun is to be elevated, is forced by compressed air into the ram, the supply being regulated by valves which are operated by means of levers in the sighting station above mentioned.

Immediately below the turret is the handling room, adjoining which are the magazine and the shell rooms, with which it communicates through doorways which, when not in use, are closed by water-tight doors. Directly below the center of the turret is a pneumatic loading machine, which rotates upon a vertical shaft, and may be swung to the right or left as desired. The 500-pound shell and the cartridge, the latter in two parts, are run out from their respective rooms on an overhead trolley and placed in the tray of the loading machine. The tray is pivotally attached to the body of the machine by a set of parallel rods and a lever which carries at its inner end a circular rack. Above the rack is an air cylinder whose piston rod terminates in a vertical rack which engages the circular rack before mentioned. By admitting air at the top of the cylinder, the tray with its load is raised to the required height and the latter is placed in the pockets of the loading car.

There are two of these cars, one for each gun, and they travel upon two vertical hoists or trackways which lead up to the breech of the guns. The hoisting is done by two pneumatic cylinders located on the floor of the turret between the guns. Attached to each piston rod and beneath each cylinder is a set of multiplying sheaves. Over these passes a wire rope, one end of which is fastened to the floor of the turret, the other end being carried to the loading car. The speed of the rope is so adjusted that the full stroke of the pistons will serve to hoist the loading car from the floor of the handling room to the breech of the gun. The loading car contains three parallel pockets, which rotate within the frame of the car, friction wheels being interposed to facilitate the movement. One of the pockets carries the shell and the other two the powder charge. The car is automatically brought to a stop with the lowest pocket containing the shell immediately in line with the breech of the gun.

It is then pushed home by a telescopic rammer which is operated by compressed air, the valve which admits the air being worked by a man who sits astride of the cylinder. The rammer is carried by a bracket bolted to an extension of the gun carriage, and it is consequently held at all times in true line with the bore of the gun. After the shell has been rammed home, the loading car is rotated and the two sections of the powder cartridge are brought successively opposite the breech and pushed home. The breech plug is then swung round, thrust into place and locked.

The recoil of the gun is controlled by two pneumatic cylinders, 14 inches in diameter and 40 inches in length. The cylinders are secured to the gun carriage and the pistons to the gun. Before firing, the pressure on the recoil side of the pistons is about 500 pounds per square inch. As the gun recoils, carrying the pistons with it, this pressure is rapidly

increased by compression. To reduce the pressure at the end of the recoil, a tapered rod is provided, which passes through the center of the piston and allows the air to pass more and more freely to the counter side of the piston as the gun returns. The residual pressure is utilized to return the gun to its firing position. Perhaps there is no part of the many operations performed by compressed air on the Terror in which the power shows to better advantage—the elasticity of the air preventing all shock and providing an easy cushion in the recoil and counter recoil.

The last and most important duty performed by the compressed air is that of steering the ship. The work is performed by two long horizontal cylinders arranged one on each side of the tiller. They are provided with a common piston rod, in the center of which is a hollow cross-head in which the tiller is free to slide as it is swung right or left by the movement of the pistons. Compressed air is admitted to the outer ends of the cylinders by means of a D valve, the air being simultaneously admitted at the back of one piston and exhausted from the other, according as the helm is to be put over to port or to starboard. Air is also admitted at all times at the inner ends of the cylinders, and a pipe connects them, so that as the pistons move, the air may flow freely from the inner end of one cylinder to the inner end of the other. In the center of the connecting pipe is a bypass valve, which is open when the tiller is being moved, but closes when it has been traversed the desired angle and holds the air imprisoned in the cylinders, thus locking the tiller between two elastic cushions. The heavy shocks to which the tiller is subject in rough weather will thus be received and absorbed by the air, and the framing of the ship will be proportionately relieved of the strain.

Provision is also made for steering the ship by electricity or by hand power. For the latter purpose an auxiliary tiller, which can be quickly coupled to the rudder head, is placed above the pneumatic cylinders. It is operated by means of an endless wire rope which passes through sheaves at the end of the tiller and round a drum attached to the deck beams overhead. The drum is controlled through a chain and sprocket gear by a large hand steering wheel shown in the engraving. The steering may also be controlled by an electric motor which is located in the same compartment. The shaft which operates the valve of the pneumatic cylinders has three clutches upon it, by manipulation of which the steering may be carried on by electrical connections from the pilot house or from either of the turrets. During the tests of last November the rudder was turned from hard a-port to hard a-starboard in the very short time of six seconds. In testing the turret engines, the air was exhausted from the receiver and the compressor was started. In a few seconds the 250-ton turret began to move, and in 45 seconds the full working pressure of 125 pounds to the square inch was realized. It took 52 seconds to swing both turrets completely around their full arc of training.—*Scientific American.*

LUBRICATING SHIPS' BOTTOMS TO INCREASE SPEED AND PREVENT FOULING.

The invention of a simple and inexpensive device for accelerating the speed of ships and preventing barnacles and corrosion has recently been brought to the attention of the Chief of Construction and other officials of the Navy Department in Washington.

The invention consists of a mechanism which envelops the submerged portion of a ship with a film of oil, thus reducing friction and overcoming to a large degree the resistance of the water.

A series of iron flanges are fastened along the bottom and sides of the ship below the water-line, in which are inserted sheets of woven wire netting, lathing or sheet iron, covered with an absorbent composition saturated with oil. The flanges have a semicircular covering on top, below which runs a finely perforated pipe which ejects a fine spray of oil against the inside of the flange and on to the sheets, from which it spreads downward.

The oil is not carried away by the water, but through capillary attraction is spread, thus keeping the ship's hull greased without any waste of oil. It is said that the composition is a perfect carrier of oil under the surface of the water, a feature which has never before been achieved and which will make oil perform below the water-line the same service that it does in quelling a rough sea.

It is said for the invention that, applied to any vessel, either steam or sailing, it will increase the speed by at least twenty-five per cent. without augmenting the amount of machinery or the expenditure of fuel. Another and most valuable feature claimed is that it will prevent the growth of barnacles. These enemies to ships' hulls necessitate frequent dry-docking and scraping, at large cost.

The inventor also declares that the fatty composition will completely prevent corrosion of hulls.

The oil used is crude petroleum, and is supplied to the pipes by tanks and valves located above the water-line. The system is so arranged that in rough weather a large quantity of oil can be discharged along the sides of the ship and distributed over the surface of the water, thus providing a more effective method of greasing and smoothing high seas than any yet devised.

The covering composition is an oleaginous preparation of tallow, calcined carbon and several other ingredients which the inventor keeps secret. It is said that it hardens in the water and cannot wash off, and can be applied to submarine war projectiles, permitting double velocity.

The inventor is Rudolf Altschul, a civil and mechanical engineer of New York City.

THE MIKLASCHEWSKI SIGNAL LANTERN.

These lanterns recently were put to a series of practical tests in squadron signaling. The lanterns, or rather the signals made by them, were visible at a distance of 34 nautical miles (60 versts), a distance not before attained by any lamps. The lanterns are very compact, and not large, weighing about 7 lbs. They are filled with alcohol and two kinds of powder, one of them green, the other red, secrets of the inventor, Colonel Miklaschewski. Attached to the lantern are two small rubber tubes with pear-shaped bulbs. Pressing these bulbs produces flares of red or green light. A glass hood is fitted to prevent extinguishing by heavy wind or rain. The powder is not affected by moisture; it was as good as dry after having been immersed in a glass of water for some little time. The storing of the powder is not dangerous. Colonel Miklaschewski claims that with his lanterns, signals can be sent a distance of 100 versts, the visibility being increased by the attachment of a mirrored reflector to the lamp.

The powder must be sifted before using. The light being very bright, it is recommended that the signal crew wear smoked glasses or turn their backs to the lantern while signaling. The lantern has been introduced into the army telegraph parks, the cavalry, fortresses and boundary guards.—*Kronstadtski Wiastnik.*

NEW REGULATIONS FOR ENTRY OF ENGLISH NAVAL CADETS.

In pursuance of the decision of the Lords Commissioners of the Admiralty gradually to raise the age for the entry of naval cadets and to shorten to some extent the period of training on board Her Majesty's ship Britannia, the following arrangements will come into force from the 1st of January: Cadets will be entered three times a year instead of twice as hitherto. The appointments will be dated from January 15, May 15, and September 15 in each year. The limits of age on each of these dates in the year 1897 will be: On January 15 and May 15, 13½ to 15 years; on September 15, 13¾ to 15¼ years. For the entry on January 15, 1898, the limits will be 14 to 15½. The limits of ages are raised gradually in order to avoid the undesirable result of cadets newly entered being older than the boys already on the Britannia entered in previous terms. There are to be three terms of about thirteen weeks in each year, to commence and terminate approximately as follows: January 14th to April 14th, May 5th to August 5th, September 16th to December 16th. The period of training on the Britannia will extend over four terms, and the examinations will be held about six weeks before the commencement of each term. The examination for the entries to be made next May and September will be conducted on the same lines as heretofore. A notification will shortly be made public as to subsequent examinations. The period of service as naval cadet afloat is to be eight months, and eight months is to be the maximum time that can be gained on passing out of the Britannia. Arrangements will be made to regulate the seniority of officers now on the Britannia who may be placed at any disadvantage owing to the introduction of these changes.

THE USE OF HOMING PIGEONS IN THE ITALIAN NAVY.

[Translated by Prof. Henri Marion, from the *Revue Maritime.*]

On the 19th of July last, 133 messenger pigeons were liberated from the torpedo-boat J. S. S., which had been designated especially for this service, at a distance of 200 km. from Spezia. The experiment was entirely successful and not a single bird was lost. The total distance was covered in 2 h. 52 m., at an average speed of 60 km. per hour. The same torpedo-boat left again Spezia on the 20th of July with 100 pigeons. After having spent the night at the island of Giametri, these pigeons were liberated at 5 A. M. at a distance of 250 km. from the Spezia loft. At 9.20 the first batch of pigeons reached their destination, and were soon followed by the others, without the loss of a single bird. The average speed made was 57,690 m. per hour.—*Revista Nautica.*

This year, during the Italian naval manœuvres, a special messenger

pigeon service was established, with headquarters on board the Sicilia, flagship of the green fleet, in charge of a lieutenant of engineers of the royal army. Additional cotes were placed on board the Savoia and Umberta, flagships of the yellow fleet, in charge of non-commissioned officers of the army, assisted by some petty officers. There were, all told, 83 pigeons. Four liberations took place, one from the Sicilia at Maddalena, with returns at Rome 15 hours afterwards; another from the Sicilia between Capraia and Vado, and two from the Savoia between the island of Elba and Monte Argentero. This service proved entirely successful.—*Italia Marinera.*

SEARCH LIGHTS IN COAST DEFENSE.

With the object of applying a practical test to the value of search lights as a protection to the entrances to Plymouth Sound, a series of experiments have lately been carried out in which the military forces had the assistance of the torpedo flotilla attached to the port. For some time past the officers connected with the Submarine Mining Establishment of the Royal Engineers at Elphinstone Barracks, Plymouth, have been giving their attention to the distribution of a system of electric lights arranged so as to cover the two approaches to the port of Plymouth and the entrance to the Hamaoze. Previous to these experiments no actual test of the scheme had taken place, and it is hoped to obtain some reliable data as to the efficient working of the scheme, and also whether it is capable of being improved. Owing to the experiments and the arrangements connected therewith being confidential, it is impossible to give any official details; but from observation and other sources, a good deal has been gathered with reference to the experiments, to which considerable importance is attached. The torpedo-boat destroyers Skate, Ferret, Lynx, Opossum, and Sunfish left Devonport about 4.30 P. M. for Plymouth Sound, with the object of returning to the harbor by passing through the areas defended by two of the powerful lights at Picklecombe and Garden Battery under Mount Edgecumbe. The Royal Engineers and Royal Artillery furnished observers at Drake's Island, the Breakwater Fort, Penlee Point, the Redoubt, Maker, Bovisand, Staddon, and some of the other defenses, for the purpose of taking rapid and accurate observations of the movements of the torpedo-boats. The experiments the first night were limited to the western entrance of the sound and harbor, and witnessed from a good point of vantage, they were to all appearances most successful. The lights at Garden Battery commanded the whole of the waters of the sound as far as Drake's Island, and notwithstanding the weather was of the worst description for experiments of this kind, it was possible from the shore to discern small objects afloat. As the destroyers came within range of the defined area they were at first only faintly visible, but as they approached the fierce light which beat upon them from the Garden Battery, they were distinctly seen from stem to stern, and in actual warfare no difficulty would have been experienced in disabling them from one or more of the numerous defenses guarding the western side of the fortress. In continuation of the recent experiments at Plymouth, a trial on a smaller scale was also made at the Needles, when the destroyers Daring and Starfish were employed, with instructions to rush past the Cliff End batteries on the Isle of Wight side and the Hurst Castle fortifications on the mainland, the channel being little

more than half a mile wide. So strong was the glare of the light that for a distance of three or four miles the lookout was practically blinded, and it was only by intimate knowledge of the locality that it was possible to steer the vessels past buoys and other obstructions. The vessels were under orders to first pass the lights and to make a dash on Portsmouth; the gunners in the forts opened fire on the boats the moment they came within observation. The Daring shot past the forts unobserved, and the artillery officer in command has since inquired how it was done, as the Starfish was under fire for three minutes and three-quarters. Now in going out to sea the vessels steamed at 18 knots, four cables apart, and, assuming they adhered to this formation, there would have been no difficulty in detecting them. The Daring extinguished her bow lights, and put on full speed, so that she passed the forts before she was expected, and, having no lights, eluded suspicion. The experiment, small in itself, is not without importance. If the raiding boat is only to make a rush at the moment she is expected, there is small chance of her success; but in this instance, by putting out her lights and anticipating expectation by a few minutes, the Daring evaded the watch. It is uncomfortable to think that the Daring did precisely what an enemy would do and that she was successful. —*Journal Royal United Service Institution.*

TESTS OF ARMOR AND SHELL.

UNITED STATES.

A test of Carnegie armor was made at Indian Head grounds on March 18. A plate, tapering from 16½ inches at the top to 9½ inches at the bottom, representing a group of side armor of 600 tons for the battleships Kearsarge and Kentucky, safely resisted the impacts of two 10-inch shells delivered with high velocities, and this without cracking or permitting penetration of the projectiles to any appreciable depth. Upon the showing thus made, Capt. W. T. Sampson recommended to the Secretary that the group be accepted. The plate was supported by an oak backing 36 inches in thickness. Two projectiles manufactured by the Wheeler-Sterling Company were employed. The first projectile, weighing 500 pounds, struck the plate at a point three and one-half calibers from the bottom and seven calibers from the end, the thickness of the metal being 12 1-10 inches. The point of the projectile penetrated three inches, and then broke, the base falling in fragments at the foot of the target. The velocity employed was 1340 feet per second. The second shell also weighed 500 pounds, and it was fired for penetration at a high velocity. The point of impact was located three and a half calibers from the top of the plate and an equal distance from the side. The plate at this point was 13 8-10 inches thick. The shell penetrated seven inches and then broke up. The metal around the point of impact was slightly dished, but otherwise the plate showed no signs of damage.

The contest for supremacy between armor and shell is always in progress. The Carnegie Steel Company has just completed a plate which it believes will eclipse anything it has yet turned out in point of resistance. The plate is 12 inches in thickness. It is made of nickel steel, but contains a higher percentage of the former metal than has yet been used in the

manufacture of service armor, and has been treated by the Harvey process with such changes in the treatment as the new conditions require. A plate of this kind was made about a year ago and was tested. While it broke into three pieces when a shell, given a velocity of 2000 feet per second, struck it, it demonstrated good resistive qualities, and the Carnegie Company determined to manufacture another plate which should be equally resistive but tougher. The firm believes that it has obtained this combination in the plate just finished. In the proposed test a 12-inch gun will be used and the velocity will be about 2000 feet per second, and higher if the results of the first shot demonstrate that another can be successfully fired.—*Army and Navy Journal.*

A test to-day, March 29, of a port plate at the Indian Head proving grounds indicated that there must be a change in the shape of plates of this character, otherwise their use may become a source of serious danger to vessels in time of war.

A Carpenter projectile, six inches in caliber, was fired at the wing of the re-entrant portion of the plate. The angle of impact was forty-five degrees. The wing was broken off through the point of impact and hurled backward with great velocity, being found about eighty feet in the rear of the target. Had the plate been fitted to the side of a vessel, the fragment, weighing about one thousand pounds, would have been driven clear across the ship and would undoubtedly have caused considerable damage.

The plate tested was five and one-half inches in thickness and was manufactured by the Carnegie Company. It represented a group designed for the battle-ships Kearsarge and Kentucky. It was fitted to a backing of three inches of oak planking and two ½-inch skin plates. A 3-inch plate, to represent a gun shield, was placed alongside the wing of the port plate. The shell was smashed into a myriad of fragments and spattered the experimental shield plate, none, however, getting through. In this latter sense the trial was satisfactory.

The test of the port plate was preceded by a trial of two plates representing the protective deck plates for the Kearsarge and Kentucky. The plates were two and three-quarters inches thick and were fired at with a 6-inch gun. The line of fire made an angle of seven degrees with the surface of the plates—the probable angle at which the protective deck could be struck. The first shell fired—a Carpenter projectile—was broken into fragments. The plate was dished, but was neither penetrated nor cracked.—*New York Herald.*

ENGLAND.

The *Admiralty and Horse Guards Gazette* reports that the trials of the new armor plate intended for the Canopus have yielded some remarkable results. It was of Harveyized nickel steel, 6 inches in thickness, and after four Holtzer projectiles of forged steel, 6 inches in diameter, weighing 100 pounds each, and striking the plate with an energy of 2665 tons, had been discharged against it, the plate was still unperforated. The *Gazette* says: "On the face of it, this is a good performance, but it is asserted that in the United States, some months ago, a 6-inch Johnson shot, with a soft steel cap, dealt very roughly with a 10-inch plate of similar quality to that now under consideration. According to the same account, an 8-inch Holtzer shot broke into pieces when fired against this

marvelous plate. If, too, we are content to rely upon the fact that we must accept accounts from the other side of the Atlantic with many grains of salt, it may be as well to remember that the Russians have made experiments which tend in the same direction. Our own trials of the soft steel cap have not been satisfactory, but other powers appear to have overcome the difficulties with which we have met. Krupp, indeed, has an astonishing record, if all the surrounding circumstances are honestly told."

At Shoeburyness, on February 28th last, a remarkable result was achieved by a Firth steel projectile fired from the 12-in. wire gun, with a striking velocity of 2300 foot seconds, at a target consisting of an 8-in. compound plate, supported by 6-in. wrought iron plate on 8 feet of oak backing with 3 inches of iron behind it. The striking energy of this shot is 31,160 foot tons, and its perforation on Tresider's system is 35.05 inches of iron. The front armor, on the regular system of calculation, is equivalent to about 28 inches of wrought iron. The projectile passed not only through this and also the backing and 3-in. skin, if it may be so called, but also passed on, entering a bank of clay and sand 30 yards in rear of the target to such a depth that it has not even yet been recovered.

The target was, of course, overmatched, supposing the projectile capable of performing the task imposed on it, but it may be seen that a projectile which will thus stand up and deliver the great energy embodied in it must be a very execellent one; and its recovery, for which we have hitherto waited, is desirable, in order to see its condition, which we should expect to be very good. We consider thick compound armor plates liable to uncertainty in their quality, but we are informed that this one appeared to be a good sample, and that the officials had no fault to find with it, and were highly pleased with the success of the shot, which the makers understood them to pronounce superior to any hitherto fired. This result is specially welcome, because high-class armor-piercing projectiles are very difficult to make, and greatly needed at the present time.

Russia.

It is reported that in last November a remarkable trial of armor took place at Ochta, near St. Petersburg. An 8-in. gun, 45 calibers long, is said to have driven a shot through a Krupp 10-in. steel plate with a hardened face. The striking velocity is given as 2850 foot seconds, and it is stated that the projectile emerged at the back with a velocity of 700 foot seconds. This is in all respects a valuable experiment. The very high velocity, the hard-faced plate, and the register of the shot after perforation are the very elements to be desired. The projectile must have been an admirable one if it held together intact. We do not know its weight. Russian 8-in. armor-piercing projectiles exist weighing 192.3 lbs., and also 172 lbs. Both are light for this caliber; the British 8-in. shot weighs 210 lbs. This makes the velocity more easy of achievement. Nevertheless it is very high for plate firing. With the heavier shot, the striking energy and perforation through iron would be 10,820 foot tons and 27.3-in., and with the lighter 9685 foot tons and 26.7-in. The shot emerged with an energy, on the supposition of the heavier weight of shot, of 653 foot tons, and of the lighter, of 584 foot tons. From this it follows that either 10,167, or else 9101 foot tons energy was expended in perforating the plate. The projectile in this case exerted a power of perforation equal to 27.0 inches, or 25.5 inches of iron. This means that the figure of the Krupp

10-in. plate was 2.7 inches or 2.55 inches; that is, it represented a thickness of wrought iron bearing this proportion to it in thickness, which argues a very excellent plate. Altogether we could wish that we had more complete data connected with this trial. We need scarcely add that on service such a plate might be safely depended on to defeat the gun. A projectile quickly loses some of its velocity, and so close a range, so direct a blow, and so excellent a shot would form a combination of favorable circumstances that would hardly occur on service.—*Engineer.*

SHIPS OF WAR.

General.

The war-ships, exclusive of torpedo-boats, launched during the year 1896 for the various navies, and their tonnage, I. H. P., and estimated speed were as follows:

Great Britain.—First-class battle-ships: Mars, Caesar, Illustrious, and Hannibal, all of 14,900 tons, 12,000 I. H. P., and 17 knots speed. First-class cruiser: Diadem, 11,000 tons, 20,000 I. H. P., and 20 knots speed. Second-class cruisers: Arrogant, Furious, and Gladiator, of 5750 tons, 10,000 I. H. P., 19 knots speed; Dido, Doris, and Isis, of 5600 tons, 9600 I. H. P., and 19.5 knots speed. Third-class cruisers: Pelorus and Pactolus, of 2135 tons, 7000 I. H. P., and 20 knots speed. Torpedo-boat destroyers: Avon, Bat, Brazen, Chamois, Crane, Desperate, Earnest, Electra, Vulture, and Whiting, of 300 tons, 6000 I. H. P., and 30 knots speed.

Argentine Republic.—Torpedo-boat destroyers: Santa Fe, Corrientes, Missiones, and Entre Rios, of 250 tons, 4000 I. H. P., and 30 knots speed.

Austria-Hungary.—Coast-defense battle-ship: Buda-Pest, of 5550 tons, 8500 I. H. P., and 17 knots speed.

Brazil.—Second-class cruiser: Barrozo, of 3500 tons, 7500 I. H. P., and 20 knots speed. Torpedo-cruisers: Caramuru and Tupy, both of 1030 tons, 6000 I. H. P., and 23 knots speed.

Chili.—First-class armored cruiser: Esmeralda, of 7000 tons, 18,000 I. H. P., and 23 knots speed. Second-class cruiser: Ministero Zenteno, of 3450 tons, 7000 I. H. P., and 20 knots speed. First-class torpedo-gunboat: Almirante Simpson, of 800 tons, 4500 I. H. P., and 21 knots speed. Torpedo-boat destroyers: Capitan Munez Gamero, Capitan Orella, Teniente Serrano, and Guardia Marina Riqueime, of 300 tons, 6000 I. H. P., and 30 knots speed.

Denmark.—Coast-defense monitor: Skjold, of 2160 tons, 2200 I. H. P., and 13 knots speed.

France.—First-class battle-ships: Amiral Bouvet, of 12,200 tons, 14,000 I. H. P., and 17 knots speed; Saint Louis and Gaulois, 11,275 tons, 14,500 I. H. P., and 18 knots speed. First-class cruiser: D'Entrecasteaux, of 8114 tons, 13,500 I. H. P., and 19 knots speed. Second-class cruisers: Catinat, Cassard, and D'Assas, of 3952 tons, 9000 I. H. P., and 20 knots speed.

Germany.—First-class battle-ship: Kaiser Friedrich III., of 11,000 tons, 13,000 I. H. P., and 18 knots speed.

Italy.—First-class armored cruiser: Carlo Alberto, of 6500 tons, 13,000 I. H. P., and 20 knots speed.

Japan.—First-class battle-ships: Fuji-Yama and Yashima, of 12,600 tons, 13,690 I. H. P., and 18 knots speed.

THE NETHERLANDS.—Second-class cruisers: Friesland and Holland, 3900 tons, 9250 I. H. P., and 20 knots speed. Station gunboat: Mataram, of 810 tons, 1100 I. H. P., and 13 knots speed.

NORWAY.—Torpedo-gunboat: Valkyrien, of 380 tons, 3300 I. H. P., and 26 knots speed.

PORTUGAL.—Third-class cruiser: Adamastor, of 1750 tons, 3000 I. H. P., and 18 knots speed.

RUSSIA.—Second-class battle-ship: Rotislav, of 8800 tons, 8500 I. H. P., and 16 knots speed. Coast-defense battle-ship: Admiral General Apraxine, of 4126 tons, 5000 I. H. P., and 16 knots speed. First-class armored cruiser: Rossia, of 12,200 tons, 17,000 I. H. P., and 19 knots speed. Second-class cruiser: Svetlana, 3711 tons, 8500 I. H. P., and 20 knots speed. First-class gunboat: Giljak, of 960 tons, 1000 I. H. P., and 12 knots speed.

SPAIN.—First-class armored cruisers: Princesa de Asturias, of 7000 tons, 15,000 I. H. P., and 20 knots speed; Christobal Colon, of 6840 tons, 14,000 I. H. P., and 20 knots speed. First-class gun vessel: Dona Maria de Molina, of 823 tons, 4600 I. H. P., and 19 knots speed. Torpedo-boat destroyers: Furor and Terror, of 400 tons, 6000 I. H. P., and 30 knots speed.

SWEDEN.—Coast-defense battle-ship: Oden, of 3300 tons, 3700 I. H. P., and 16 knots speed.

UNITED STATES.—First-class battle-ship: Iowa, of 11,410 tons, 10,000 I. H. P., and 16 knots speed. First-class gunboats: Helena, Vicksburg, and Newport, of 1392 tons, 1600 I. H. P., and 13 knots speed.—*Journal Royal United Service Institution.*

[UNITED STATES.]

TORPEDO BOAT NO. 5.

Torpedo-boat No. 5, the third and last of the torpedo-boats under construction for the Navy by the Columbian Iron Works, of Baltimore, was launched at the company's yard, January 6th. Her total cost will be $97,500. She is constructed of steel of the regular Navy requirements, is 160 feet long and 16 feet broad, with a displacement of 142 tons. Her armament will consist of three 18-inch Whitehead torpedo tubes on her upper deck, trained to fire at any angle, and three 1-pounder rapid-fire guns. She is estimated to be capable of a speed of 24½ knots per hour. Her machinery comprises two triple expansion, four cylinder engines, one on each side shaft, in water-tight compartments. The indicated horse-power is 2000. Her coal capacity will be forty-four tons. Her crew will consist of twenty-four men, with four officers.

TORPEDO BOAT NO. 6.

Torpedo-boat No. 6 on its trial trip maintained an average speed of 28.74 knots per hour for a distance of 60 miles. This is equal to 33.1 statute miles per hour, a speed which not a great many years ago would have been equal to the average all-day speed of our passenger trains.

The course was 12 miles long and it was covered in five successive runs. On the first run she crossed the line carrying a steam pressure at the engines of close upon 220 lbs. to the square inch, and her engines were running at the high speed of 405 revolutions per minute. There were

two excellent features that were immediately apparent to those on board, the first being the absence of any banking up of a heavy bow wave (the commotion which our readers will notice in the cut being merely the surface foam); the second good feature was the absence of that extreme vibration which is usually felt in a torpedo-boat when she is pushed to her full speed. The quiet way in which she cuts through the water will be an invaluable feature during a night attack. It will increase the chances of stealing up to the enemy unobserved, and the silence and smoothness with which her engines run at high speed will also be greatly in her favor. It was remarked by the officials on board that the vibration was not sufficient to interfere with writing legibly in any part of the vessel. Any one who has been aboard one of the 30-knot torpedo-boat destroyers on a trial trip will appreciate what this statement means. It is well known that torpedo-boat service is about the most trying that exists in any navy, and much of its discomfort arises from the perpetual jarring to which the crew are exposed. The vibration is due to the fact that such enormous horse-power is crowded into a little vessel of extremely light construction.

It is a difficult problem to place in a boat only 175 feet long and 17½ feet wide a set of 4000 twin engines that shall drive the propellers at over 400 revolutions per minute, and do it without shaking the little craft from stem to stern. The lightness of the construction of No. 6 may be judged from the fact that there is not a plate in her hull that is more than a quarter of an inch thick.

The first heat of twelve knots was run off in 24 m. 52 s., at a speed of 28.97 knots. The second was made in 24 m. 57 s., corresponding to 28.85 knots. The third trial resulted in a speed of 28.78 knots, and the fourth showed a speed of 28.87 knots. The average for the 48 knots was, therefore, 28.87 knots. The last run had scarcely commenced when one of the blowers broke down, a mishap which caused a falling off of the steam pressure and brought down the speed to 28.23 knots, which was 0.73 knot above the contract requirement. The average speed of the whole 60 knots was 1¼ knots above the contract speed of 27½ knots.

The manœuvring powers of the new boat are excellent, the turns at the end of each run being made in a very small circle, and although the helm was "hard over," the amount of "heel" was insignificant.

She carries three torpedo launching carriages, one forward on the port side, one amidships on the starboard side, and a third at the stern on the center line. She is also armed with three 1-pounder rapid-fire guns. The full complement of the little ship is four officers and twenty-four men.

The remarkable success of this little craft will give increasing interest to the trials of the three 30-knot boats which are now building for the Navy, one on the Pacific coast and two on the Atlantic. If they show as great an advance on contract requirements as No. 6 has done, it is possible that the record for torpedo-boat speed may remain for a few months on this side of the water, or until the new 32-knot destroyers for the English Navy shall have had their trials.—*Scientific American.*

Trial Trip of the Helena.

With a light westerly breeze and scarcely a ripple on the waters of Long Island Sound, the gunboat Helena speeded across a twenty-seven mile course to-day at a rate of 15.81 knots an hour, exceeding the contract speed of thirteen knots, required of the vessel, to such an extent that she earned a bonus of about $56,000, or $16,000 more than her sister ship, the Wilmington, which had her official trial last Saturday.

Both the Trial Board and the builders' representatives speak in glowing terms of the two gunboats, especially of the Helena, which steamed over the course and back to-day with machinery working to perfection, and vibration that was scarcely perceptible from her deck.

The boat weighed anchor at half-past six o'clock this morning, and with a parting wish for good luck from the crew of the Wilmington, close by in the stream, glided out of the harbor and was ready for the signal to fly past the torpedo-boat Porter, two hours later, at the starting point of the course. In the fireroom everything was ready for the forced draught, doors were closed air-tight and water-tight, and the blower was revolving at a rate of speed that sucked in the outer air in great volumes.

The ship met the first of the ebb tide at the start and had it against her all the way. But it was not strong, and on the run home she had its favoring impulse. The men in the fireroom were sweltering during the running of the boat under forced draught, but they endured it bravely. They were liberally furnished with ginger ale.

The way the ship sped along on the first reach from the Porter, about three and a half miles from Horton's Point, made it evident that she was making fast time. On the outward run to Old Field Point the maximum revolutions of the screw were 282 and the minimum 276, the average being 279. The average in knots was 15.34. The run back was made as soon as the ship had made a turn or two and run long enough to permit the indicator cards to be run out.

The total elapsed time for the first half was 1 hour 45 minutes 37 seconds and for the last half 1 hour 39 minutes and 25 seconds, making the total elapsed time for the full run of twenty-seven knots 3 hours 25 minutes and 2 seconds.

When the run was ended the Helena kept going until she had run out her four hours and made several circles. The coal consumption on her four hours' run was seven tons.

The Wilmington sailed for Newport News about five o'clock this afternoon, and the Helena will follow to-morrow.—*New York Herald.*

[ENGLAND.]

THE ISIS.

Her Majesty's second-class cruiser Isis has undergone a very satisfactory thirty hours' coal-consumption trial at both natural and forced draughts. According to the *Naval and Military Record*, with natural draught, her engines indicated 8208 horse-power, with a mean speed of 19.8 knots per hour; while at her forced-draught trial her engines averaged 9840 horse-power, with a speed of 21.1 knots per hour. The specifications provided for 8000 horse-power with natural, and 9600 with forced draught. She has been built by the London and Glasgow Shipbuilding Company.

THE NIOBE.

H. M. S. Niobe was successfully launched on February 20 from the yard of the Naval Construction and Armament Co., Barrow-in-Furness. The vessel is one of eight, six of which are being built by contract, four on the Clyde and two at Barrow, while the other two are being constructed at Pembroke Dockyard. The Niobe is 435 ft. in length between perpendiculars, but the overhanging stern and the projecting ram make the

length over all 463 ft. The breadth over sheathing is 69 ft., and her moulded depth to the upper deck 39 ft. 9 in. The mean load draught of the vessel is 25 ft. 3 in., at which draught the displacement is 11,070 tons. The hull of the vessel is constructed of Siemens-Martin steel, with a 4-in. sheathing of wood to 9 ft. above the load water-line, the heavy external framing of the ends, stem and sternpost and propeller brackets, and the rudder frame being, as is usual in sheathed vessels, phosphor-bronze castings. The rudder is of the balanced type, and the stem curved outwards under the water so as to form a formidable ram. Two long bilge keels 3 ft. deep are also fitted to prevent rolling. Amidships the vessel's bottom is constructed on the cellular principle, the inner skin being carried to the protective deck. The double bottom, or the space between the two skins, is minutely subdivided into water-tight compartments which are partly used for the carrying of water, and afford security against sinking should the outer skin be pierced. By water-tight bulkheads and water-tight flats the vessel is throughout closely subdivided.

The protection consists of an armored deck of steel plating 4 in. thick at the crown, and extends the whole length of the vessel. It is arched in section, rising from 6 ft. under the water-line at the side of the vessel to 4 ft. above the water-line at the crown of the arch. Under the deck, which is raised for the purpose in way of the engines, are placed the propelling machinery, the steering engines and gear, the capstan engines, the air-compressing machinery, and all the magazines, shell-rooms and torpedo-rooms. The coal bunkers, which have a capacity for over 2000 tons of coal, are arranged along the sides of the boiler-rooms and along the sides of the vessel on the protective deck above the engines and boilers, thus affording most satisfactory coal protection to the machinery of the vessel. The armament of the vessel, as will be seen from the following, is of a most powerful description. There are sixteen 6-in. quick-firing guns, twelve 12-pounder quick-firing guns, three 3-pounder quick-firing guns, two 12-pounder boat and field guns, and eight .45-in. Maxim machine guns. The Niobe is supplied with three torpedo-tubes, one of them firing right aft above the water-line, while two broadside under-water tubes are placed under the protective deck in a special compartment forward. The 6-in. guns and 12-pounder guns will be supplied with ammunition through armored tubes extending from the protective deck to the deck on which the guns are worked. An ammunition passage is arranged on each side of the ship below the protective deck and extending for the whole length of machinery space. The passage is completely protected by coal on top, sides and bottom, so that the ammunition need never be exposed to fire in its course from the magazines to the guns. The total complement of the vessel, including the admiral's staff, will be 718 men, for whose comfort every provision is made.

The Jupiter.

H. M. battle-ship Jupiter, built by the Clydebank Engineering and Shipbuilding Company, Limited, completed her official trials at Chatham on March 5. On the 2nd the vessel went out for her four hours' full-power forced-draught trial, during which time a steam pressure of 150 lbs. was easily maintained with an air pressure of .62 in. of water. The vacuum in condensers was 26.6 in. The port engine ran at 101.7 revolutions per minute and developed 6127 indicated horse-power. The starboard engine, running at 102.4 revolutions per minute, developed 6348 indicated horse-

power, the collective indicated horse-power being 12,475, which gave a mean speed for the four hours of 18.4 knots. The designed power was 12,000 indicated horse-power, and the speed 17½ knots.

On the following day the eight hours' natural draught trial was commenced, and this trial was also satisfactory, as with .2 in. air pressure a mean steam pressure of 148 lbs. was kept up, and the engines developed a collective indicated horse-power of 10,248. The mean speed on this trial was 15.8 knots; but record was only taken by log, which is often far from reliable.

On the next day, the 4th, the vessel started the 30 hours' coal consumption; on this trial, with a mean collective indicated horse-power of 6193, the coal consumed per indicated horse-power per hour amounted to 1.51 lbs. The mean steam pressure during this trial was 146 lbs., the vacuum 26.6 in. The starboard engine, running at 81.5 revolutions, developed 3116 indicated horse-power, and the port engine, running at 81.1 revolutions, developed 3077 indicated horse-power. The Jupiter is of the Majestic type.

The Pegasus.

The Palmers Shipbuilding Company, Newcastle-on-Tyne, launched, on March 4, two vessels, one a third-class cruiser named Pegasus, and one of several 30-knot destroyers, the Flying Fish. The Pegasus belongs to the Pelorus class.

The principal dimensions are as follows: Length between perpendiculars, 300 ft.; breadth, extreme, 36 ft. 6 in.; depth, moulded, 21 ft. 2 in.; displacement, on a mean draught of 13 ft. 6 in., 2135 tons; indicated horse-power, 7000; speed, 20 knots.

The armament consists of eight 4-in. quick-firing guns, eight 3-pounder quick-firing guns, three .45-in. Maxim guns, and two 14-in. torpedo-tubes. Two of the 4-in. guns are placed on the forecastle deck, one on the port side, and one on the starboard side; two on the poop deck, one on each side; and four on the upper deck between the poop and the forecastle, two on each broadside.

Two of the 3-pounders are placed forward on the upper deck, one on each side of the bow; two are placed aft on the upper deck, one on each side of the stern; and four on the upper deck between the poop and forecastle, two on each broadside.

Two of the .45-in. Maxim guns are placed on the hammock berthing amidships, and one on the forecastle deck. The torpedo-tubes are on the upper deck, one on each broadside.

The Flying Fish.

The Flying Fish is the sixth of eight vessels of the same type which Palmers' Company are building for Her Majesty's Government. Her dimensions are: Length, 215 ft.; breadth, 20 ft. 9 in., and the displacement is about 300 tons. Her armament consists of one 12-pounder quick-firing gun forward on the conning tower, two 6-pounder quick-firing guns on each side, and one 6-pounder on a platform aft. There are also two revolving torpedo-tubes on deck arranged to fire on either side. The builders have guaranteed a speed of 30 knots, and as a matter of fact the sister ship Star maintained a speed of 31 knots for three hours, proving herself the fastest vessel afloat; the machinery, which has been designed by the builders, consists of two sets of triple-expansion engines, steam being

supplied by four of Reed's water-tube boilers. The Whiting, another of the destroyers built by Palmers' Company, has run a number of times over the measured mile at an average speed of 30.2 knots, and was kept running for three hours at an average speed of 30.1 knots.

It has been decided to arm the new second-class cruisers Hermes, Highflyer, and Hyacinth, which are now being built, with more powerful guns than was intended when the vessels were originally designed. It was at first arranged that they should have five 6-in., six 4.7-in., and 16 smaller quick-firing guns. Under the new order they will each have eleven 6-in., nine 12-pounders, and six 3-pounder quick-firing guns.

[FRANCE.]

CHANGES IN DOCKYARD ORGANIZATION.

During the discussion on the naval estimates in the Chamber, Vice-Admiral Besnard, Minister of Marine, announced that it had been decided to effect important changes in dockyard organization, which would comprise the complete separation of the supervision of ships already constructed from those building.

The new regulations have now been settled, but before putting them into practice they will be finally submitted to the Committee of Inspectors-General.

The *Temps* gives the following account of the new proposals:

The main principle is to be continuity of command of the ship from the day she leaves the hands of the constructor, the naval officer then appointed to the command retaining the same ship till promoted or retired. It will be his duty to be responsible for the armament, mobilization and repairs of the ship, and he alone will be the judge of any alterations to be introduced, as the ship will never afterwards be placed in the hands of the Constructive Department.

The new duties of the naval officer will necessitate the creation of a new department in the dockyards, that of "Direction de la flotte," at the head of which in each port will be placed a rear-admiral as inspector-general.

The "Service de la flotte" will have its own storehouses and will be in a position to maintain all the ships in its charge in an effective condition. The Constructive Department will only intervene when the repairs are such as to necessitate the assistance of the full dockyard staff; in such a case the "Service de la flotte" will act towards the Constructive Department in the same way as if the work was being performed by private contract; it will superintend and have entire control of the work performed, and all materials supplied and any changes required in the working hours of the workmen employed will have to receive its sanction, so that it will not be possible in the future to charge other expenses to the repairs of ships with a view of hiding mistakes made in estimates for new constructions—a practice which has often been complained of and condemned by members of the Chamber.

The "Service de la flotte" will be charged with the duty of preparing ships for mobilization, and for this purpose will possess special storehouses to contain all consumable stores to be issued to the ships on commissioning, and also all non-consumable stores belonging to completed ships. In principle, each ship belonging to a port will have its own separate store, but it may be found possible to avoid this expense and make each ship its own storehouse.

[GERMANY.]

RESTRICTIONS IN USE OF WOOD FOR INTERIOR FITTINGS OF SHIPS.

As the result of the experiences drawn from the battle of the Yalu, the use of wood has been much restricted in the new German ships. According to Herr A. Dietrich, Constructor-in-Chief of the Imperial Navy:

"In the outfit and construction of the new German ships wood is used only for a few minor points. Wooden deck planks are no longer laid; steel deck plating is covered with linoleum, sometimes over a layer of cork. In the crews' quarters the sides of the ships are not ceiled; in the officers' rooms the ceiling is made of steel plates 1½ millimetres thick and lined with cork. For cabin bulkheads the steel is covered with thin woollen cloth, and with cork lining underneath where it is desirable to exclude sound or lower the temperature. Where heat is radiated from engine or funnel casings, cork lining is resorted to. All wood is removed from the ammunition rooms, save the racks for shells and powder charges, which are still made of wood. For all ladders and steps steel is used. The handrails on the conning bridges are no longer of wood, but of some other material which will not burn or splinter, and which is more agreeable to the touch of the hand than steel or brass. Chart-houses and captains' rooms on bridges are entirely made of steel and fitted out with non-combustible materials. Since all such changes will be a little exaggerated, it seemed to be advisable to abandon wood for the interior fittings, and especially for the furniture, and to resort to fireproof material which will not splinter. Many things were tried; furniture was made of steel and aluminum, lined with cork and covered with linoleum or canvas; but it was not equal to wood furniture. Only the bedsteads are constructed of iron, steel or brass. The insignificant quantity of wood in the few pieces of furniture when ignited is not a dangerous source of smoke, but rather it is the outfit of the state-rooms, the mattresses, blankets, clothing, books, etc. However, for the present, wood cannot be abandoned entirely. Top signal masts, flag poles, etc., will be made of steel, but there one cannot save weight. The fighting capacity of the ships is without doubt increased through these innovations, since the ship is less apt to burn, the effects of splinters are restricted, and considerable weight is saved, which is available for ordnance and armor."

It may also be mentioned that in German ships-of-war the protective under-water deck is never cut through either for ventilation or coaling purposes.

[SPAIN.]

TORPEDO-BOAT DESTROYERS FUROR AND TERROR.

The torpedo-boat destroyers Furor and Terror, designed and built by Messrs. James and George Thomson, Limited, Clydebank, to the order of the Spanish Government, have now completed their trials, and have arrived in Spain. Although similar in general design to the destroyers of the British Navy, there are several departures in detail, and the vessels are in some respects more nearly akin to the torpedo gunboats. For example, they are fitted with teak upper decks in addition to a complete steel deck; double awnings for the whole length of the vessel, with side curtains hanging to the water's edge, electric lighting throughout, and a number of electrical ventilating fans for insuring a supply of fresh air to

the officers' and crew's quarters; so that the vessels will be much more habitable than an ordinary torpedo-boat destroyer when serving in the tropical or semi-tropical climates for which they are intended. The contract provided that the mean speed should be determined by four runs on the measured mile, and by a further trial of two hours' duration, during which the speed should not be less than 28 knots. It was further stipulated that a load of 75 tons should be carried on trials, which is more than twice the load required in the case of vessels of a similar type built for the British Navy.

The vessels have a length of 220 ft., breadth 22 ft., and have a moulded depth of 13 ft. The loaded displacement is 380 tons. The armament consists of two 14-pounder quick-firing guns, the one mounted forward on top of the conning tower and the other aft; two 6-pounder guns of the same type mounted on the broadside, and two 37-millimetre automatic quick-firing guns, one on the starboard and the other on the port bow. All these guns have been supplied by the Maxim-Nordenfeldt Guns and Ammunition Company, Limited, and are of the latest and most improved pattern. The vessels are also equipped with two torpedo-tubes, 14 in. in diameter, mounted on the upper deck, so as to fire off either side of the ship. The torpedo-tubes are on the Schwartzkopff system. Four torpedoes are carried, and there is, of course, a complete installation of air-compressing machinery for charging them, the engines and pumps being in the engine-room.

After some preliminary trials, the Furor successfully passed her official forced-draught trial on October 30. The mean speed of four runs on the measured mile exceeded the contract by about a quarter of a knot, and the revolutions were maintained without difficulty for the two hours' trial. The Terror, after a single preliminary trial, completed her natural-draught trial, and, at the next succeeding trial, successfully completed her official forced-draught trial. The natural-draught trials were of the same duration as the forced-draught trials, and it was provided by the contract that a speed of 21½ knots be maintained with the air pressure in the stokeholds not exceeding ¾ in. of water. It was found that this speed could be maintained with very great ease; indeed, the stipulated speed was exceeded by about a knot.

After the speed trials, the firing trials of the guns were carried out to the entire satisfaction of the inspecting officers. The terribly destructive nature of the fire, especially from the automatic guns, was very apparent, a perfect hail of projectiles of 37 millimetres, or about 1½ in. in diameter, being delivered by these guns, and continued so long as the person firing the gun kept his finger pressed on the trigger, the whole of the operations of loading and firing being automatically performed by the energy of the recoil.

On Saturday, February 6, the Clydebank Engineering and Shipbuilding Company (Limited), launched from their yard at Clydebank a twin-screw torpedo-boat destroyer built to the order of the Spanish Government. The vessel, which was named the Audaz, is of greater tonnage than the Furor and Terror, lately delivered from the same yard, and will carry the same armament, but she will be two knots faster.

The firm of J. and G. Thomson, Clydebank, has received contracts from the Spanish Government for the construction of sixteen torpedo-boat destroyers of the Furor and Terror type.

New Spanish Floating Dock.

The well-known shipbuilders on the Tyne, Messrs. Robert Stephenson & Company, Limited, have definitely concluded negotiations with the Spanish Government for the building of a floating dock, to be located at the port of Olongapo, Philippine Islands. The dock, which will be the largest yet constructed anywhere, is of the following dimensions: Length, 450 ft.; width, over pontoons, 117 ft.; depth to the top of side walls or girders, 38 ft. 6 in. The dock, when completed, will rest on a series of six pontoons, each of which will be between 13 ft. and 14 ft. deep. These latter will be constructed of iron; while the side girders, which constitute the walls of the dock, will be of steel. The arrangement of the pontoons in the design is such that in the event of any of them getting damaged and requiring to be repaired, it can be temporarily detached from the rest of the structure and floated on to the dock itself. The dock is intended to lift vessels up to 12,000 tons, and will have an equipment of four powerful pumping engines, capable of pumping 12,000 tons of water in two hours. Though capable of taking vessels 500 ft. long, the weight of which will be pretty evenly distributed over the whole of the structure, it is specially designed to lift vessels of the maximum weight—12,000 tons—the length of which may not exceed 300 ft. In the latter case it is evident the pressure will be concentrated in a smaller area, and will, therefore, test more severely the stability of the whole. To give to the structure the necessary strength for resisting central pressure or distributed pressure with equal certainty, special care has had to be taken in the designing. For convenience of shipment the dock is to be built in sections, which in due course will be sent out to Olongapo, where the structure will be finally put together and completed.—*London Engineer.*

[Portugal.]

New Cruisers.

The Portuguese Government has placed contracts with La Société des Forges et Chantiers de la Méditerranée for two cruisers of 1800 tons displacement, to be built in Havre. Dimensions to be as follows: Length, 246 feet; beam, 35 feet; draught, 14 feet; horse-power, 2650. The armament comprises two 15-cm., four 12-cm., and eight 4.7-cm. Canet guns, all on Canet mounts with shields. The torpedo armament consists of a submerged bow tube. Speed to be 15 knots.

[Norway.]

Harald Haarfagre.

On January 4 was launched from the Elswick yard on the Tyne the Harald Haarfagre, a new armor-clad for this government. She is the first important armored ship built for the Norwegian Navy, and her dimensions are as follows: Length, 280 feet; beam, 48 feet 6 inches; and with a mean draught of 16 feet 6 inches, her displacement will be 3500 tons. Protection is afforded by an 8-inch armor water-line belt and a 2-inch armored deck. The armament will consist of two 21-cm. (8-in.) guns, mounted in hooded turrets protected by 8-in. armor, one forward and one aft, four 6-in., six 12-pounder, and six 1½-pounder guns, all Q. F., with two discharges for 18-in. torpedoes. A sister ship is also under construction at the same yard.

VALKYRIEN.

The torpedo-boat destroyer Valkyrien, completed last year by the Schichau firm at Elbing for the Government, maintained a mean speed of 23.2 knots during her official trials, the engines making 240 revolutions and developing 3300 I. H. P., the boilers being Thornycrofts. She is a vessel 188 feet 6 inches long, 23 feet beam, and with a draught of 7 feet has a displacement of 380 tons. The armament consists of two tubes on deck for 18-inch torpedoes, one amidships and one aft, with one 6-pounder and one 1-pounder Q. F. guns. The cost of the Valkyrien was defrayed by subscriptions collected by the Patriotic Ladies' League.

DELFIN, HAI, AND HVAL.

Three first-class torpedo-boats, the Delfin, Hai, and Hval, have just been completed and delivered by the Schichau firm of Elbing; they are 120 feet long, are fitted with Thornycroft's boilers, and have a mean speed of 23 knots. They carry two 18-inch torpedo-tubes on deck and two 1-pounder Q. F. guns.

[SWEDEN.]

ODEN.

The Oden, one of the new type of improved Svea battle-ships, is now almost ready for her trials, while two others, the Thor and Njord, are nearly ready for launching. The Thor is being constructed at the yard of the Bergsunds Maschinenfabrik in Stockholm, and the Njord at the yard of the Lindholmens Fabrik in Gothenburg; the engines are being constructed by the Motala firm; both ships are to be completed by the end of 1898. The dimensions of these ships are as follows: Length, 277 feet 4 inches; beam, 47 feet 10 inches; and with a maximum draught of 16 feet 6 inches they will have a displacement of 3400 tons. The engines are to develop 3700 I. H. P., giving a speed of 16 knots. There is a 12-inch armor water-line belt for about two-thirds of the length of the ship, and a 4-inch casemate amidships for six 15-cm. (5.9-inch) Q. F. guns; the principal armament consists of two 24-cm. (9.4-inch) guns, one forward and one aft in hooded barbettes protected by 12-inch armor, and there are also ten 6-pounder Q. F. guns, four machine guns, and an under-water bow torpedo-tube. The armor for all three ships is being made by the French firm of Schneider at Creusot. The heavy guns for the Oden and Thor will be made by the French firm of Canet, while those for the Njord will come from the Swedish manufactory at Bofors. It is stated that the Bofors establishment is to be taken over by M. Nobel, of Paris, and will be greatly enlarged.

JARNAN AND EDJERN.

The two torpedo cruisers Jarnan and Edjern, now nearly ready for launching, are of a similar type to the Ornen, their dimensions being as follows: Length, 220 feet; beam, 27 feet 6 inches; a displacement of 670 tons; with engines developing 4000 I. H. P., to give a speed of 19 knots. The armament will consist of two 12-cm. (3.9-inch) Q. F. and four 6-pounder Q. F. guns, with one torpedo-tube.

[BRAZIL.]

COAST DEFENSE BATTLE-SHIPS.

The two small coast-defense battle-ships building for this government at the La Seyne Yard, near Toulon, are to be called the Marshal Deodoro and Marshal Ypiranga. Their dimensions are to be as follows: Length, 267 feet 6 inches; beam, 48 feet; displacement, 3162 tons, with a draught of 13 feet 2 inches. Protection will be afforded by a water-line belt of 13.7 inches of nickel steel, tapering, however, to about half that thickness at the bow and stern, and by an armored deck 1.3 inches thick. There will also be a central redoubt protected with 28-inch nickel steel armor, and two armored turrets 8 inches thick, one forward and one aft, for two heavy guns, which will be 24-cm. (9.4-inch) Canet guns; four 12-cm. (4.7-inch) Q. F. guns will be mounted in the redoubt and two 15-cm. (5.9-inch) howitzers on the spar deck, with four 6-pounder, two 1-pounder Q. F. guns, two machine guns and two submerged tubes. The engines will develop 3400 I. H. P., steam being supplied by Lagrafel d'Allest water-tube boilers, and the speed is to be 15 knots. The coal storage will be 236 tons, and the crew will consist of 200 officers and men.

THE CARAMURU.

The new torpedo cruiser Caramuru, one of three building at the Germania yard at Kiel for the government, has lately completed her steam trials, when a mean speed of 22 knots was obtained. The following are the dimensions of the Caramuru and her two sisters: Length, 255 feet 6 inches; beam, 29 feet 6 inches; and with a draught of 9 feet 9 inches they have a displacement of 1030 tons. The engines are to develop 6000 I. H. P., giving a speed of 23 knots. The armament consists of two 4-inch, six 6-pounder, and four 3-pounder guns, all Q. F.'s, with two broadside and one bow tube for 18-inch torpedoes. Two first-class torpedo-boats are building at Elbing, and two river monitors at Rio de Janeiro.—*Journal of the Royal United Service Institution.*

[CHILI.]

ESMERALDA.

The new first-class cruiser Esmeralda has just been completed by Sir W. G. Armstrong & Co., at Elswick, for the Chilian Government. She may, perhaps, be regarded as a very much improved Blanco Encalada, which was completed in 1894 for the same government. She has a much more powerful armament, greatly increased protection, greater speed, and a larger coal-carrying capacity than the last-named ship; and now that she has satisfactorily passed through all her trials, and is lying ready to start for her destination, she must certainly be regarded as one of the most formidable cruisers afloat. A brief description will convince any one of this who will take the trouble to compare her qualities with those of cruisers of the same and greater displacement belonging to other nations.

Her length between perpendiculars is 436 feet; beam, 53 feet 2 inches; mean draft, 20 feet 3 inches, and a displacement of just over 7000 tons. Her full coal supply is 1350 tons, an amount which would enable her to cross the Atlantic at a speed of over 20 knots and, of course, give her an enormous radius of action at more moderate speeds. The vessel is

sheathed with wood and coppered. Her armament is as follows: Two 8-inch Q. F. guns, placed one forward and one aft; sixteen 6-inch Q. F. guns, four firing right forward and four right aft, and the remaining eight on the broadsides; eight 12-pounder Q. F. guns, ten 6-pounder Q. F., four Maxim guns, and three torpedo-tubes.

In addition to a curved protective deck, 1½ inches to 2 inches in thickness, extending over her whole length and covering all the vitals of the ship, she has over more that three-fourths of her length a belt of Harveyized armor 6 inches thick and 7 feet deep, terminated by armor bulkheads of the same thickness. Her conning tower, containing all apparatus for working and fighting the ship, is protected by Harveyized armor 8 inches thick.

The Esmeralda was commenced during the latter half of 1895, and she has been complete for some weeks, so that she has been considerably less than a year and a half building—a remarkably short time for a vessel of her size and power. Her machinery is of the four cylinder vertical triple-expansion type, driving twin screws; and the I. H. P., which was exceeded on trial, is 15,000 with natural draught. She is provided with forced draught, which would give her a power of 18,000 horses, but the Chilian Commission has been so satisfied with the results of speed and power attained with natural draught that no use has been made of forced draught.

Her official steam trials took place in September, and consisted of a full-speed trial with natural draught, which lasted for six consecutive hours. During the trial runs were taken on the measured mile, and a mean speed of over 23 knots was obtained with and against the tide, and the H. P. which gave this speed was maintained and part of the time exceeded during the six hours. In addition to the above, an endurance trial was taken lasting 24 hours, during which three-fifths of the full power, namely, 10,800 horses, was maintained, giving the vessel a speed of over 20 knots per hour.

The gun-firing trials took place off the Tyne on February 16th, the guns and structure of the ship being put to the severest possible tests. The 8-inch gun and four 6-inch guns were fired simultaneously in the line of the keel and horizontally, the shot passing only a few feet above the deck over the admiral's state-room, and yet no damage was done. All the guns were also fired simultaneously by electricity, which is also used as the motive power for training the 8-inch guns and the hoists for the 8-inch and 6-inch ammunition.—*Journal Royal United Service Institution.*

The official trial of the torpedo-boat Injeniero Hyatt, built by Messrs. Yarrow & Co. for the Chilian Government, took place at the mouth of the Thames on Monday, February 15th, when a speed of 27.2 knots was obtained over the Maplins with a pressure of steam of 195 lbs. This vessel and the torpedo-boat Cirujano Videla, tried last month, are being fitted out to join the Chilian squadron, which will shortly leave this country.

[JAPAN.]

Japan's Navy in 1906 will, according to present plans, consist of 6 line-of-battle ships, 12,517 to 15,140 tons; 1 second-class battle-ship, 7315 tons; 6 first-class armored cruisers, 9000 tons; 7 second-class cruisers of over 4000 tons; 6 third-class cruisers of over 3000 tons, and 12 fourth-class cruisers or gunboats of over 1500 tons.

[CHINA.]

At the Vulcan Shipbuilding yard, Bredow, near Stettin, where the Chinese torpedo gunboat Fei Ying was built in 1895, three protected cruisers for the Chinese Government are in hand. They are sister ships of 2950 tons, 328 ft. long, with 41 ft. beam and 16 ft. 6 in. extreme draught. Protection is given by steel decks varying in thickness between 1½ in. and 2½ in., and the guns are to have steel shields. The armament will consist of three 6-in. and eight 4-in. Krupp quick-firers, six 1.4-in. Hotchkiss quick-firers, and six Maxims, and there will be three above-water torpedo-tubes. The machinery has been built at the Vulcan Works, and engines of 8000 horse-power, driving twin screws, are to give a speed of 19.5 knots. The normal coal supply of each cruiser will be 220 tons, and her complement 250 officers and men. At the same yard the German second-class cruisers K (5650 tons) and N (5900 tons) are in hand.

BOOK NOTICES.

THE ROYAL NAVY, by Wm. Laird Clowes, a history of England's Navy from the earliest times to the present, will appear in five royal 8vo volumes, with 25 photogravures and many full page and other illustrations, maps, charts, etc.; published by Sampson Low, Marston & Company, Limited, London.

Volume I., from the beginning to 1603, is nearly ready; it will extend over 700 pages. The remaining volumes will appear at intervals of about six months. Each volume will be complete in itself, with an index.

Mr. Clowes is assisted by Sir Clement Markham, K. C. B., P. R. G. S., Captain A. T. Mahan, U. S. Navy, Mr. H. W. Wilson, Mr. Theodore Roosevelt, Mr. E. Fraser and others.

Captain Mahan is preparing the campaign of the American Revolution, and Mr. Roosevelt that of the War of 1812 to 1815. The co-operation of American and English writers in the preparation of this work must commend itself to all students of history, establishing the fact that the historical verdict of both parties is substantially the same.

ALMANACH FÜR DIE K. U. K. KRIEGS-MARINE, 1897, Redaction der "Mittheilungen aus dem Gebiete des Seewesens," Pola. Price 4 Mark, 20 Pf.

This Marine Almanach replaces the former annual by the same publishers, viz., Almanach der Kriegsflotten, and it has become a more voluminous edition, the present number containing 485 pages, with 192 plates of battle-ships. Part I. is devoted to tables of weights, measures, and reductions from metric to English measures. Part II. contains tabular statistics of the Austrian Merchant Marine, with complete lists of merchant steamers. Part III. is devoted to the Imperial Yacht Club, containing lists of members and of the yachts. Part IV. contains interesting data on the pay in the Imperial Austrian Navy, regulations concerning pay of the personnel while on active service, on various detached service, pensions, pilot fees, regulations governing admission into the Naval Academy, medical corps, pay corps, etc. Part V. tabulates the data for naval ordnance of all nations. Part VI. contains the navy lists of the world, concluding with a comparative table showing the relative strength of the navies in battle-ships, cruisers, torpedo-boats and submarine boats. The fund of useful information contained in this handy pocket annual recommends it, irrespective of the fact that it is the product of the editorial office of the Mittheilungen aus dem Gebiete des Seewesens, a long-standing authority on naval matters.

THE 10TH ANNUAL OF AIDE-MÉMOIRE DE L'OFFICIER DE MARINE, 1897, by Edouard Durassier, continued by Charles Valentino, published by Henri Charles Lavauzelle, Paris, continues its high standard as a book of reference on naval matters.

As heretofore, the book opens with a comparative table of the modern navies of the world, followed by a recapitulation of naval events of the different nations during the past year. Besides the notes on international law, personnel, vessels, artillery, torpedoes, submarine cables, and various reduction tables, there have been added in this edition tables showing the distances of the French naval and military ports from the principal ports of the world, also the principal formulæ in geometry and trigonometry.

The book appears in its usual genteel form, with no increase in the moderate price of 5 francs.

THE NAVAL POCKET-BOOK, 1897, by W. Laird Clowes, published by Neville Beeman, Ltd., London, is the second issue of the handy pocket reference book, the first issue of which last year was hailed with pleasure as filling a long-needed work of this kind in the English language.

This volume is somewhat larger than last year's issue, due to the introduction of numerous additional plans of ships and the admission of fresh matter.

As stated in the preface, an effort has been made, as before, to present in a manner favorable for reference and comparison the statistics of the various navies; and, with this end in view, while the official classification of vessels has been retained, a secondary classification, based upon power, size, speed and newness, has been introduced.

As a result of this secondary classification throughout the work, ships of approximately equal fighting value may be recognized at a glance on reference to the letters A, B, C, D., etc., under which they are ranked.

After the classified list of navies follow a summary of ships of the more important classes belonging to leading navies; notes on guns and small arms, on torpedoes, on naval personnel and comparative rank; lists and particulars of dry docks; miscellaneous tables of weights and measures and their conversion from metric into English system or reverse; concluding with trial-trip tables. H. G. D.

BIBLIOGRAPHIC NOTES.

[AMERICAN.]

SCIENTIFIC AMERICAN.

JANUARY 2, 1897. Compressed Air in Working Guns. Samohod's Nautical Register.

JANUARY 9. Military Ballooning. New Docks at Gibraltar. Homing Pigeons. Nickel Steel.

JANUARY 16. Commercial Navies of the World.

JANUARY 23. Antarctic Explorations.

JANUARY 30. 1000 Horse-power Boilers.

FEBRUARY 6. Russia takes American Armor Plate. The Cruiser Terrible. Rapid Military Firing.

FEBRUARY 13. Stability of the Battle-ship Indiana. Our New Torpedo-boats.

FEBRUARY 20. The Brooklyn Navy Yard Timber Dry Dock.

The dimensions of the new dock No. 3 are: Length on coping, 670 feet; breadth on coping, 151 feet; depth of water on sill, 29 feet.

FEBRUARY 27. Lessons of the Naval Manœuvres. The Freight Steamer Pennsylvania of the Hamburg-American Line.

This is in some respects the largest ship in the world, her principal dimensions being as follows: Length, 560 feet; beam, 62 feet; depth, 42 feet; maximum draught, 30 feet; loaded displacement, 23,400 tons; horse-power, 5500; speed, 14½ knots.

MARCH 6. The New Navy Bill. Torpedo-boat No. 6. Merrimac Shipbuilding.

THE UNITED SERVICE.

JANUARY, 1897. Society in Washington. Ball's Bluff. Rear-Admiral James Edward Jouett, United States Navy. Some Experience with the Cheyennes. The World beneath the Ocean.

FEBRUARY. A Knowledge of Human Nature is Half the Science of War. Legion d'Honneur de France. Modern Rifle Shooting. The Sword.

THE IRON AGE.

JANUARY 7, 1897. The Kearsarge and Kentucky Plates. The Cost of Armor Plate.

JANUARY 14. Roller Bearings in Steam Engines. A large Car Ferry Boat.

JANUARY 21. Inspecting Steel Plate for the Navy. The Bethlehem Plate Mills (illustrated). The Cost and Price of Armor Plate.

JANUARY 28. Steel Productions in Great Britain in 1896. Bearings of Marine Engines. The New Magazine Rifle. Aluminum-coated Sheets. Cost of Armor Plate.

FEBRUARY 4. The German-Austrian Mannesmann Tube Works. Naval Steel Inspectors. The Tendency of Naval Armaments.

FEBRUARY 11. The Incandescent Lamp—Past and Future.

FEBRUARY 18. Test of Armor Plates. The Armstrong-Whitworth Consolidation. Torpedoes in the Navy.

FEBRUARY 25. Progress of Naval Vessels building.

MARCH 11. Encourage American Shipping. Collapse of a Pair of Corrugated Furnaces (illustrated). Swedish Armament.

MARCH 18. The Tube Mill of the United States Projectile Company. The New Armor Plate Contract.

MARCH 25. Nickel and Nickel Steel. The Duquesne Furnace Plant of the Carnegie Steel Company.

JOURNAL OF THE MILITARY SERVICE INSTITUTION.

JANUARY, 1897. Proper Military Instructions. Military Surgery of Future Wars. The Batson Sketching Case. Promotions in the National Guard. Use of Troops in Civil Disorders.

MARCH. The Lyceum at Fort Agawam. Land Mines. Army Uniform. Battle Tactics and Mounted Infantry. Artillery Firing Charts. The Field Outfit for an Infantryman.

THE ENGINEER.

JANUARY 2, 1897. Internal Corrosion in Steam Boilers. The Efficiency of Screw Propellers.

JANUARY 16. The Prince George. Progress in American Shipbuilding. Nickel Steel.

JANUARY 30. The Blake Twin Vertical Air Pumps in the Kaiser Wilhelm der Grosse. The Bearings of the Marine Engine. Removing a "Shrunk-on" Gun Jacket.

FEBRUARY 13. The Indianapolis Pumping Engine. The Engines H. M. S. Swordfish and Spitfire. The Slide Valves of the Terrible, R. N. The Bazin Roller Steamship. Advantages of Mechanical Stoking. Proposed Use of Compressed Air on Men-of-War. Efficiency and Management of Steam Boilers.

MARCH 13. Pitting and Corrosion of Steam Boilers.

SEABOARD.

JANUARY 7, 1897. Our own Ships for our Foreign Trade.

JANUARY 14. Progress and Promise in American Shipbuilding.

JANUARY 21. A New Sleeve Sounding Lead.

ENGINEERING NEWS AND AMERICAN RAILWAY JOURNAL.

JANUARY 21, 1897. The Improvement of Marquette Harbor, Michigan. Tests of an Experimental Turret of the U. S. Battleship Massachusetts.

JOURNAL OF THE ASSOCIATION OF ENGINEERING SOCIETIES.

DECEMBER, 1896. The Galveston Harbor Works. Structural Strength of Ships and improved Arrangements for Repairing them without Diminution of their Strength.

FEBRUARY, 1897. Resistance of Ships and other Floating Bodies at Deep and Shallow Drafts of Water.

THE JOURNAL OF THE FRANKLIN INSTITUTE.

JANUARY, 1897. The Standard of Efficiency for Steam Engines and other Heat Motors.

FEBRUARY. Speed Variations in Crank Shafts. Aluminum Alloys. Aluminum Manufacture in Europe. The Storage Battery in Europe.

MARCH. Ice Caves and the Causes of Subterranean Ice. Equalizing Connections for Compound Wound Dynamos coupled in Multiple. Domestic Statistics of the Aluminum Manufacture in 1896.

JOURNAL OF THE AMERICAN SOCIETY OF NAVAL ENGINEERS.

FEBRUARY, 1897. A Method of Determining a Continuous Record of the Performance of a Marine Engine. The U. S. S. Terror and the Pneumatic System as applied to the Guns, Turrets and Rudder. The Speed Problem. On Crank Shafts. Hollow Steel Forgings. Steel Forgings. Machinery Bearings. The Bearings of the Marine Engine.

ELECTRICAL ENGINEERING.

MARCH, 1897. Calculations of Circuits.

CASSIER'S MAGAZINE.

JANUARY, 1897. Boiler Feed Pump Efficiency. Power Transmission from Niagara Falls. American Lake and Ocean Steamship Models.

FEBRUARY. The Whitehead Automobile Torpedo. Steamboats on Western American Rivers. Ancient Pompeiian Boilers. The Bazin Roller Boat.

Full illustrated description of the Bazin. After an account of the experiments with the first models, the author states: "These experiments will be repeated on a much larger scale when the Ernest Bazin is made ready for its trial trip, and many of the French naval experts and marine engineers expect that they will be equally successful. The present boat is intended only for service in the English Channel and other coast waters, but in the event of its success it may be the forerunner of a fleet of transatlantic liners, constructed on the same principles, with such modifications as experience may suggest."

MARCH. Some Early American Steam Craft. The Age of Electricity. Electrically Annealing Armor Plates on a Battleship.

PROCEEDINGS AMERICAN SOCIETY OF CIVIL ENGINEERS.

VOL. XXIII, No. 1. Wind Pressures in the St. Louis Tornado (illustrated).

JOURNAL OF THE U. S. CAVALRY ASSOCIATION.

DECEMBER, 1896. The Screening Duty of Cavalry. Night Operations (concluded). Scott and Harney: an Official Episode of the Mexican War. The Practical Work Course in Engineering for Cavalry Officers at the Infantry and Cavalry School.

AMERICAN ELECTRICIAN.

JANUARY, 1897. An Electric Yacht. Mechanical Stokers and Shaking Grate Bars. The Equalizer. How to make an Induction Coil. The Steam Engine Indicator. Faults of Railway Motors—their detection, cause and remedy.

FEBRUARY. An Interesting Example of Practical Expedients. Rotary Converters. Dynamo Characteristics. The Slide-valve Diagram. Lessons in Practical Electricity.

MARCH. Application of Electricity to Bank Burglary. The Storage Battery in Telegraph Work. How to make a Telephone. Lessons in Practical Electricity.

[FOREIGN.]

JOURNAL OF THE ROYAL UNITED SERVICE INSTITUTION.

DECEMBER, 1896. Biographical Sketch of His Majesty William II., German Emperor and King of Prussia, K. G., etc. The Functions of the Navy and Army in the Defense of the Empire. On Pistols. The Highland Rising of the '45 from a Military Point of View. Lime Juice. The use of Aluminum for Military Purposes.

JANUARY, 1897. The New Chilian Armored First-class Cruiser Esmeralda. Recognition of Belligerency considered in relation to Naval Warfare. The Evolution of the Militia as the Basis of the Army. Notes on Tactics for Ships and Weapons of the Present Day.

FEBRUARY. On the Employment of Retired Bluejackets, Soldiers and Marines. The Invasion of England: should London be Fortified? Notes on Tactics for Ships and Weapons of the Present Day (Part II).

MARCH. The New French First-class Battle-ship Carnot. The Militia in 1897. On Company Field Training. German Naval Policy and Strategy.

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DECEMBER 25, 1896. The American Society of Naval Architects and Marine Engineers (illustrated). The Machinery of the S. S. Kherson (illustrated). Canet Naval Guns (illustrated). Shipbuilding and Marine Engineering in 1896 (illustrated).

JANUARY 1, 1897. Shipbuilding and Marine Engineering in 1896. Water-tube Boilers. Torpedo-boat Destroyers Furor and Terror (illustrated). The Manufacture of Aluminium. The Bearings of the Marine Engine.

JANUARY 8. The New Mersey Pilot Steamers. Experiments in Steel-making in Japan. Shipbuilding and Marine Engineering in 1896.

JANUARY 15. The Engines of H. M. S. S. Swordfish and Spitfire. Water-tube Boilers. The Pumps of the Kaiser Wilhelm der Grosse. The Bazin Roller Ship. The Trials of H. M. S. Terrible.

JANUARY 22. Submarine Telegraphy. American Opinions of Japanese Industry.

JANUARY 29. New Rifle for the United States Navy. Labor on Government Work.

FEBRUARY 5. The Japanese Battle-ship Yashima (illustrated). Military Works. The Russian Pyrocollodion Powder.

FEBRUARY 12. Fiske's Engine Telegraph and Speed Direction Indicator (illustrated). The Russian Pyrocollodion Powder.

FEBRUARY 19. The Russian Pyrocollodion Powder. The Machinery of the Japanese Battle-ship Yashima (illustrated). Submarine Telegraphy. The Jaureguiberry and Boiler Tubes. The Prevention of Vibrations of Steamships (illustrated).

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MARCH 5. The Launching of H. M. S. Niobe (illustrated). The Navy Estimates. The Cruiser Pegasus and the Destroyer Flying Fish.

MARCH 12. Thames-built Battle-ships (illustrated). The Navy in Parliament. British Battle-ship Jupiter.

MARCH 19. Hamlyn's Collapsible Boat Chocks (illustrated). The Navy Estimates. The British Cruiser Pelorus (illustrated).

THE ENGINEER.

DECEMBER 25, 1896. H. M. S. Prince George. H. M. S. Albion.

JANUARY 3, 1897. Armor for the Kearsarge and Kentucky (illustrated). Shipbuilding for 1896. Corn-pith Cellulose. War Material. New American Battle-ships.

JANUARY 8. Modern Japan: III. The Yokosuka Dock Yard. The Bearings of the Marine Engine (illustrated).

JANUARY 15. Absence of a Standard in Battle-ship Design. Comparative Cost of English and American Boilers. H. M. S. Terrible. New Battle-ships.

JANUARY 22. Attack on Fortifications by Ships. Maritime Improvements at Dunkirk. H. M. S. Prince George: Capstan Gear. Trial of Cammell's 6-in. Plate.

JANUARY 29. A New Secondary Battery. Who was the Pioneer of Armor Plates? The Johnson Capped Shot (illustrated). The Kherson (illustrated). Defects in French Battle-ships.

FEBRUARY 5. Our Present Position in Ordnance and Armor. Diagrams from the Engines of H. M. S. Powerful (illustrated). Modern Japan: Industrial and Scientific: No. V (illustrated). Sir W. Armstrong, Whitworth & Co., Limited.

FEBRUARY 12. Tests of an Experimental Turret of the U. S. Battle-ship Massachusetts. The Maxim-Cordite Case.

FEBRUARY 19. New Canet Quick-fire Gun for the Greek Navy (illustrated). The Battle-ship Ocean.

FEBRUARY 26. German Naval Estimates. The New Cruiser Niobe. Russian Armor Trial. The Japanese Battle-ship Fuji.

MARCH 5. Watt and the Measurement of Power. The Cordite Case. Baxter's Steering Gear. A New Sectional Gun (illustrated).

MARCH 12. The Programme and Estimates for 1897–8. Water-tube Boilers and Liquid Fuel.

MARCH 19. U. S. Monitor Puritan (illustrated). Accident to the Corrientes Torpedo-destroyer (illustrated). Recent Trials of Firth's Shot and other Armor-piercing Projectiles.

PROCEEDINGS OF THE ROYAL ARTILLERY INSTITUTION.

JANUARY, 1897. Report on the German Manœuvres of the XIV. German Army Corps in Baden, September, 1896. African Animals. The Duties in Action of the Lieutenant-Colonel Commanding a Siege Train Division. Artillery from an Infantry Officer's Point of View.

FEBRUARY. A Two Months' Trip into Mongolia. Artillery Positions and Screening Guns. Formula for finding Speed of Objective. A Plea for Speed Firing with Garrison Artillery Guns. The German Method of bringing Guns into Action. Colonel James Wemyss. Captain Bogue and the Rocket Brigade. Mountain Artillery Drill.

THE STEAMSHIP.

JANUARY, 1897. Internal Corrosion in Steam Boilers. Launch of a Brazilian Cruiser at Elswick. Launch of the Cruiser Furious. Marine Engineering Returns for 1896. A New Marine Engine.

FEBRUARY. Clyde-built Light-draught Steamers. The Bearings of the Marine Engine (illustrated). Atlantic Records during the Past Year. Submarine Cables and their Enemies. German Shipbuilding Trade. The "Harman" Patent Feed-water Heater (illustrated).

MARCH. Marine Boiler Explosions. The Edison & Swan Electric Light Fittings for Ships (illustrated). O'Brien's Watertight Doors for Ships (illustrated). Thrust Bearings for Propeller Shafts (illustrated). Suction *vs.* Forced Draught for Marine Boilers. Marine Propellers. Trial Trip of H. M. S. Isis.

UNITED SERVICE GAZETTE.

JANUARY 2, 1897. A Year's Warship-building. Methods of Manning the Navy.

JANUARY 9. The Armament of Cavalry—II.

JANUARY 16. Steam Engineering in the United States Navy.

JANUARY 23. The Victory of Shot over Armor.

JANUARY 30. The Effect of Electricity on the Flight of Projectiles.

The Committee of the Federal Shooting Association made a curious discovery lately in tabulating certain results of shooting. It observed that on the range at Winterthour the majority of shots fired at the targets on the right of the range struck to the right of the bull's-eye, while on the targets on the left of the range the greater number of hits were to the left of the bull's-eye. It was further discovered that all the projectiles constructed either partly or wholly of steel had become magnetized during flight.

The Federal Experimental Committee having had these facts brought to their notice, thought that possibly they might have some connection

with the existence of the numerous wires used for electric bells and telephones on either side of the range. Several additional experiments were made on other ranges and the results fully bore out this theory.

An electric current of 8000 volts was installed on the range at Thun by means of four 18-mm. cables laid parallel to the line of fire and 40 m. from it. In order to define the trajectory, screens of thin paper were fixed at every 10 m. along the range.

The first trials were made with the 1889 pattern rifle. The influence of the electric current made itself felt at once; at 260 m. the lateral deviation was already 24 m. The trajectory showed a very remarkable curve towards the electric current.

A second trial was made with the Japanese gun of 3.3 mm. invented by Colonel Yamagata. The minute bullet went straight for the electric wires, broke two insulators, and followed along the wires, finally wearing out its energy with the friction.

Experiments were then made with artillery. The results obtained were no less startling. The range was 3000 m. and the electric current was installed as before, commencing at 2800 m., *i. e.* 200 m. in front of the target. The lateral deviation of the shell (common) was 14 degrees. Firing with shrapnel produced even more curious phenomena. The head of the projectile, carrying the fuse made of a non-magnetic metal, was completely detached, while the body was attracted by the current, the bullets after burst showing such extraordinary variations that all accuracy of fire was totally done away with.

It was proved by these experiments that the force of attraction increases in inverse ratio to the weight of the projectile and also to its velocity. A section of infantry exposed to the fire of hostile infantry at 300 m. and having on one flank an electric current (by means of a dynamo or accumulators) would have nothing to fear from the enemy's bullets. A company at 500 m. could be protected in a similar way, and a like arrangement would be a safeguard from artillery fire at from 900 to 1400 m.

FEBRUARY 6. Control of the Dardanelles. British Command of the Sea.

FEBRUARY 13. The Naval Defense of Australia. Hygiene in the Navy.

FEBRUARY 20. The Defense of Great Britain. Homing Pigeons.

Good progress has been made this week with the erection of a pigeon loft at Mount Wise, Devonport, where it is proposed to keep about two hundred birds to be trained as seafaring messengers. The light walls on which the loft will rest are nearly completed, and the loft is expected to be ready for use by the end of March. It is understood that a sum of £300 or £400 will be voted in this year's estimates for erecting a pigeon loft at Rat Island, Portsmouth, in the immediate vicinity of the Victory, where the signaling instruction is carried on.

Hygiene in the Navy (II.).

FEBRUARY 27. A Naval Tactical School.

MORSKOI SBORNIK.

DECEMBER, 1896. Suggestions for increasing the Efficiency of our New Ships (translation of article from Naval Institute Pro-

ceedings, by W. J. Baxter). Commerce Destroyers in War. Armament of German Fleet. Extent of Influence of Damage to Side upon the Stability of the Ship. Water Tubular Boilers on Ships of War. The Gyroscope Collimator. Shipbuilding Abroad. Loss of French Torpedo-boat No. 83. Bursting of Steam Pipe on board the Huascar.

JANUARY, 1897. "Old and New": comparison of Russian and British Admiralty Organizations. Considerations upon Questions in Naval Tactics (Admiral Makaroff). Commerce Destroyers in War. Comparative Strengths of the Fleets of the Chief Naval Powers. Trials of the Machinery of the English Cruiser Powerful. Meteorology as a Factor in Time of War. Naval Construction Abroad. Experience of the British Cruiser Talbot in a Gale. Bursting of Boiler on Swedish Torpedo-boat. Notes on Hydrography and Physical Geography.

FEBRUARY. Considerations upon Questions in Naval Tactics. Comparative Strengths of the Fleets of the Chief Naval Powers. Commerce Destroyers in War. Preservation of Locomotive and Water Tube Boilers. Torpedo Nets for War-ships. The Grounding of the Cruiser Russia. Naval Construction Abroad. Collision of the Blenheim with the French Sailing Ship France. Bursting of Boiler on Swedish Torpedo-boat. Hydrographic Notes. Ordnance Notes: New English 6-in. Guns. Adoption in the German Navy of large-calibre, quick-firing Guns up to 9.45 in. J. B. B.

MILITÄR WOCHENBLATT.

No. 1, 1897. Canet Field-piece, M. 1896.

NOS. 7 AND 8. Small Arms. Instructions in Use of Arms.

No. 9. Camp Utensils of Aluminium in France. Breech-closing Apparatus of Rapid-fire Guns.

No. 16. Weight of English Shrapnel. New Austrian Guns for Fortifications.

NOS. 17 AND 18. Estimating Distances. Russian Naval and Military Estimates for 1897.

No. 19. Infantry Rifles.

Gives development of the military rifle from 1550 to present time. The tables show that the weight of the rifle has been nearly constant during the 400 years. It is only within the past 15 years that any marked reduction in weight has occurred, from about 10 lbs. to 8.4 lbs. The calibers have been decreasing from 17.5 millimeters (.68 in.) to as low as 5 millimeters (.19 in.)

DEUTSCHE HEERESZEITUNG.

No. 102, DECEMBER 19, 1896. Aid to Wounded on the Battlefield. Increase of Italian Navy.

Nos. 1 and 2, 1897. New Shipbuilding Programme for 1897, from first reading in the Reichstag.

No. 3. Wounds made by Modern Rifle Bullets, and Choice of Field Hospitals.

Colonel Bricher, corps surgeon of the 2nd Swiss Army Corps, has made, during two years, extensive researches as to the effect of modern bullets and the dependent choice of field hospitals. He believes that the total percentage of losses calculated with reference to the whole army will not increase, but that the percentage will be greater in case of troops actually engaged. He believes that the number of killed, as compared to the wounded, will increase, and the injury to blood-vessels will lead to increased cases of bleeding to death. His comparisons are as follows: Past battles—wounds in the head, 12; body, 18; upper limbs, 30; nether limbs, 40 per cent.. Future battles—head, 20; body, 15; upper limbs, 30; nether limbs, 35 per cent. An increase in the number of heavy wounds is not probable, notwithstanding the severe shattering of bones at great distances.

Canet Rapid-fire Gun, Model 1896.

No. 7. French Naval Programme for 1897. Comparison of Fleets of Chili and Argentine.

Nos. 12 and 13. Holland's Shipbuilding Programme. Losses in Men-of-war and Personnel during the year 1896. Comparison of Navies of Principal Nations.

No. 15. French Ships of War to be completed 1897 to 1902.

No. 17. Trafalgar and to-day.

Nos. 18 and 19. The German Navy, from first reading in the Reichstag. Trafalgar and to-day (continued).

MARINE RUNDSCHAU.

January, 1897. The History of the Imperial Navy (continued). On Observations made during Launchings (with three plates).

It has been the custom in recent years to make certain fixed measurements and observations during launchings from the Imperial dockyards at Kiel and Wilhelmshaven.

The object of these measurements was to determine what conditions of motion and resistance arise in direction of descent, in order to determine from these the influence of total weight, surface pressure, temperature, kind and amount of lubricating material upon the coefficient of friction, as well as the proper incline of the ways.

Furthermore, it was attempted to measure the motion of the ship in a direction at right angles to the ways, in order to answer the following special questions: Were the ways deformed by blocking up? Was any hogging of the ship caused by insufficient length of ways? Was the ship water-borne too soon or too late? Did any grounding take place?

This interesting paper describes the apparatus used, with illustrations, and results of determinations in the cases of launchings of the Falke, Kaiserin Augusta, Hagen, Kolmar, Aegir and Bonn.

Trial Trips of H. M. S. Odin. The United States Navy (concluded). Naval Notes.

FEBRUARY. The History of the Imperial Navy (continued). Raising of the Steamer John Siem, sunk in Kaiser Wilhelm Canal. The Nicaragua Canal. Our Sailors' Uniforms. Naval Notes.

MARCH. The History of the Imperial Navy (continued). Search-light for Army and Navy. The Iltis Typhoon of July 22 to 25, 1896. The Hongkong Plague Epidemic. Development of the German Colonies. Foreign Naval Notes.

ANNALEN DER HYDROGRAPHIE UND MARITIMEN METEOROLOGIE.

No. I., 1897. Remarkable Changes in the Deviation of the Steamer Phoenicia's Standard Compass during her first Year's Trips. Lunar Observations for determining Ship's Position at Sea.

No. II. Photography on board Ship.

Instruction in uses of camera, development, dark room, etc.

Organization, Development, latest Improvements, and present Status of French Lighting Systems. Ground Ice in Sea Water.

MITHEILUNGEN AUS DEM GEBIETE DES SEEWESENS.

VOL. XXV., No. II. The Exploring Expedition of H. M. S. Pola in the Red Sea, 1895 to 1896. Armor Trials of Witkowitz Plates (illustrated). New Battle-ships of the United States. Captain Gaynor's Automatic Sight. The Simplex Ice Machine of Duncan, Stewart & Co. Speed of Torpedo-boat Destroyers. Fishing with Use of Electric Lights. Foreign Navies.

Nos. III. AND IV. Austria's War in the Adriatic in the year 1866. H. G. D.

LE YACHT.

No. 980, DECEMBER 19, 1896. The Navy Estimates. The Loss of the Salier: Variations of the Compass near the Coasts of Spain.

No. 981, DECEMBER 26. The Navy in Parliament.

The animated debates on the navy bill show conclusively that France is alive to the inferior position in which she finds herself placed in regard to the European maritime nations, with whom she may become involved in war in the near future, and has come to the conclusion that her naval policy consists in the building of powerful rapid cruisers, at least twenty of them, limiting armor protection to protective decks, and belted water-lines extending only part of the length of the ship. Mortar-avisos are thought preferable to destroyers, because they are capable of attacking battle-ships and bombarding cities, and prove at the same time a formidable match against torpedo-boats.

No. 982, JANUARY 2, 1897. The New Constructions.

No new fact of a general order developed during the year 1896. The contest goes on between armor and high explosive projectiles. Already the latter penetrate plates of a medium thickness of 150 mm. on the upper works, where their effects will prove all the more destructive, as they will explode in the interior of vessel. Will it be possible to increase still further the thickness of these plates and thereby augment the weight of the superstructures? The limits of the defensive power must soon be reached, whilst those of the offensive are still a great way off. The solution of the problem will likely be found in a return to the monitor class of vessels and the high-speed cruiser, aided by the gunboat and the torpedo-boat. Only two armored battle-ships were launched, the Gaulois and St. Louis, of the Charlemagne class, 11,725 tons, 14,000 horse-power and 18 knots, besides the first-class cruiser d'Entrecasteaux, 8114 tons, 14,000 horse-power and 19 knots; the second-class cruisers Cassard, D'Assas and Catinat, 3952 and 4065 tons, 9500 horse-power and 19.2 knots; finally, the third-class cruiser Galilée, 2320 tons, 6400 I. H. P. and 20 knots.

No. 983, JANUARY 9. The French Navy in 1896. The Steam Ferry-boat Finnieston.

No. 984, JANUARY 16. The Question of the Personnel in the Navy.

No. 985, JANUARY 23. Apropos of Naval Strategy.

In his article, M. Em. Duboc advocates the use of commerce destroyers in a possible war with England, and cites the immense losses caused by the Alabama during the War of the Rebellion.

No. 986, JANUARY 30. The English Cruisers Blake and Blenheim. The United States Navy.

No. 987, FEBRUARY 6. The Navies of the World.

A review of the fleets of the principal maritime nations.

No. 988, FEBRUARY 13. The French Mediterranean Squadron.

Major A. Court, in a recent article in the Nineteenth Century, undertakes to examine the French naval policy and makes a picture of the fleet which is anything but reassuring. Commenting upon the article, M. Em. Duboc proposes some reforms in the administration of the department, tending in some extent to remedy the situation.

No. 989, FEBRUARY 20. Naval Tactics and Strategy (Em. Duboc).

The writer deplores the absence of interest in naval tactics and of well defined strategic plans in view of an eventual conflict with England.

No. 990, FEBRUARY 27. Endurance of Boilers and Engines.

J. L.

LE MONITEUR DE LA FLOTTE.

No. 2, JANUARY 9, 1897. War on Commerce (Guerre de course).

Rear-Admiral Dubasof, Naval Attaché at Berlin, has just delivered in the Library Hall of the Navy Department at St. Petersburg a very

interesting lecture on "Cruisers and Naval Warfare." Admiral Dubasof does not favor war on commerce, and says it is a mistake to think that this kind of warfare is an important factor in the final result, which can only be decided in a pitched battle between the two hostile fleets. The Admiral also believes that without the support of battle-ships, cruisers can render but little service, and is opposed to their dissemination in different parts to operate like so many Alabamas. As an offset to the preceding, in an article that appeared in the Revue Maritime of November last, Commander Farret contends that war on the enemy's commerce (especially when England is considered) may have very appreciable results. In case of the well-marked inferiority of one of the combatants and the immense commercial navy of the superior, commerce-destroying warfare becomes evidently the arm of the feeble against the strong. Commander F., however, sees difficulties in the way of such warfare, as, for instance, the dispositions to be made of the captured vessels with inadequate prize crews.

No. 5, JANUARY 16. Battle-ships and Cruisers: their Connecting Link.

No. 7, JANUARY 30. The Superior War College and the Capitaines de corvette: Advantages in reinstating the Grade.

No. 8, FEBRUARY. The Situation in Crete. J. L.

RIVISTA MARITTIMA.

DECEMBER, 1896. The Yarrow and Thornycroft Boilers. Use of Torpedo-boats.

JANUARY, 1897. Notes on Naval Strategy.

BOLETIN DEL CENTRO NAVAL.

DECEMBER, 1896. Williams: the Changes in the Armament of the Almirante Brown. Steel for Ordnance (continued).

JANUARY, 1897. Our Oceanic Coasts (apropos of the book of Sr. Chaigneau). Armor and Modern Projectiles. The Armored Battle-ship José Garibaldi.

RIVISTA DI ARTIGLIERIA E GENIO.

NOVEMBER, 1896. Graphics of Convergence. A Study on Telephony.

REVISTA TECNOLOGICO INDUSTRIAL.

DECEMBER, 1896. Railway Traction and the Means of facilitating it (continued). Altimetry: Measuring Heights by means of the Barometer, Hipsometer, etc. Association of Civil Engineers of Barcelona.

REVUE DU CERCLE MILITAIRE.

No. 51, DECEMBER 19, 1896. Alpine Military Shelters in Italy (end). Aluminum Camping Utensils in the French Army.

No. 1, JANUARY 2, 1897. The Corps of Frontier Guards in the Russian Army.

Nos. 3, 4. Organization and Use of Cyclists' Units in the Army.

No. 5. The Chinese Eastern Railway.

No. 6. The Spirit of Initiative in the Army.

REVUE MARITIME.

DECEMBER, 1896. A Note on the Behavior of the Chronometers of the Marceau. A Practical Guide to the Conduct of Court-martials and Courts of Inquiry on board of Men-of-war. The Electric Tachymeter. Remarks on Naval Tactics.

Commander Rudolf Labrés, of the Austro-Hungarian Navy, published in January and February, 1896, in the "Mittheilungen aus dem Gebiete des Seewesens," a study on naval tactics. The Revue gives an extract of this interesting work, pointing out its most salient features and insisting upon the new ideas emitted by the author. J. L.

REVIEWERS AND TRANSLATORS.

Lieut. J. B. BERNADOU, U. S. Navy. Lieut. H. G. DRESEL, U. S. Navy.
Prof. JULES LEROUX.

ANNUAL REPORT OF THE SEC. AND TREAS. OF THE U. S. NAVAL INSTITUTE.

To the Officers and Members of the Institute:

Gentlemen:—I have the honor to submit the following report for the year ending December 31, 1896.

ITEMIZED CASH STATEMENT.

Receipts during Year 1896.

Items.	First Quarter.	Second Quarter.	Third Quarter.	Fourth Quarter.	Totals.
Dues	$585 00	$706 89	$335 41	$360 51	$1987 81
Subscriptions	197 34	156 67	156 45	160 92	671 38
Sales	111 50	53 25	136 00	20 92	321 67
Interest on bonds	96 33	9 00	55 53	9 00	169 86
Advertisements	113 75	120 00	152 50	57 50	443 75
Binding	14 00	14 05	8 85	11 00	47 90
Life membership fee	30 00	. . .	30 00	30 00	90 00
Premium on money orders	40	. . .	53	. . .	93
Credit	50	. . .	. . .	. . .	50
Sale of check	. . .	. . .	17 00	. . .	17 00
Totals	$1148 82	$1059 86	$892 27	$649 85	$3750 80

Expenditures during Year 1896.

Items.	First Quarter.	Second Quarter.	Third Quarter.	Fourth Quarter.	Totals.
Printing	$6 50	$541 72	$1201 54	$382 15	$2131 91
Salaries	300 00	300 00	300 00	300 00	1200 00
Postage	39 13	46 53	50 46	36 68	172 80
Expressage	5 37	4 80	2 75	3 50	16 42
Freight and hauling	2 04	6 58	4 42	3 50	16 54
Binding	13 00	20 80	. . .	. . .	33 80
Stationery	7 84	38 35	95	1 25	48 39
Office expenses and furniture	1 55	. . .	3 00	41 00	45 55
Telegraph and telephone	15	89	40	25	1 69
Prize	100 00	. . .	. . .	. . .	100 00
Gold Medal	15 50	2 00	. . .	. . .	17 50
Rebates	. . .	10 70	. . .	93	11 63
Insurance	. . .	8 40	. . .	. . .	8 40
Purchase back No. and check	. . .	1 00	17 00	. . .	18 00
Purchase D. C. bonds R. F.	. . .	. . .	. . .	110 75	110 75
Totals	$491 08	$981 77	$1580 52	$880 01	$3933 38

Summary.

Balance of cash unexpended January 1, 1895	$4423 99
Total receipts for 1896	3750 80
Total available cash, 1896	$8174 79
Total expenditures	3933 38
Cash unexpended January 3, 1897	$4241 41
Cash held to credit of reserve fund	59 14
True balance on hand January 1, 1897	$4182 27
Bills receivable for dues 1896	651 00
" " " back dues	856 75
" " " binding	22 00
" " " subscriptions	52 50
" " " sales	12 43
" " " advertisements	137 50
Value of back numbers (estimated)	2000 00
" " Institute property	100 00
	$8014 45

Reserve Fund.

United States 4 per cent. Consols, registered	$900 00
District of Columbia 3.65 per cent. registered bonds	2000 00
" " coupon bonds	650 00
	$3550 00
Cash in bank uninvested	59 14
	$3609 14

Membership.

The membership of the Institute to date, January 1, 1897, is as follows: Honorary members, 5; life members, 109; regular members, 570; associate members, 190; total number of members, 874.

During the year 1896 the Institute lost by death, resignations and dropped, 45 members. 35 new members' names were added to the rolls—17 regular, 6 associate, 4 life members; 3 regular members became life members—one, the prize essayist.

Members Deceased Since Last Report.

Honorary Members.

Jones, J. D., 1896.

Life Members.

Tyler, George W., Lieut.-Commander, U. S. Navy, Feb. 17, 1896.
McGiffin, Philo N., Captain, February 11, 1897.

Regular Members.

Stevens, Thomas H., Rear-Admiral, U. S. Navy, May 15, 1896.
Cooke, A. P., Captain, U. S. Navy, September 7, 1896.
Newell, John S., Commander, U. S. Navy, September 3, 1896.
Crocker, F. W., Commander, U. S. Navy, October 31, 1896.
Gillpatrick, Commander, U. S. Navy, October 10, 1896.
Babcock, William C., Lieutenant, U. S. Navy, March 11, 1896.
Coffin, J. H. C., Lieutenant, U. S. Navy, January 4, 1897.

Baker, C. H., Chief Engineer, U. S. Navy, May 6, 1896.
Mercer, Samuel, Captain, U. S. Marine Corps, July 22, 1896.

ASSOCIATE MEMBERS.

France, J. R., November 6, 1895.
McClymont, E. E., December 29, 1895.
Pratt, N. W., March 10, 1896.

The Institute had on hand at the end of the year the following copies of back numbers of its Proceedings:

Whole No.	Plain.	Bound.	Whole No.	Plain.	Bound.
1	109	....	41	259	19
2	240	....	42	108	19
3	51	....	43	168	3
4	143	...	44	60	10
5	118	....	45	41	19
6	.....	....	46	49	19
7	1	....	47	31	19
8	31	....	48	50	18
9	35	....	49	18	17
10	.....	....	50	62	17
11	211	....	51	35	18
12	50	....	52	55	16
13	1	....	53	160	34
14	2	....	54	3	4
15	.....	....	55	55	17
16	225	....	56	465	53
17	.....	....	57	21	19
18	105	....	58	2	7
19	109	....	59	17	18
20	126	1	60	.....	1
21	222	1	61	190	18
22	267	1	62	147	16
23	177	1	63	178	37
24	187	1	64	30	18
25	1040	43	65	124	18
26	212	90	66	17	16
27	300	27	67	10	15
28	2	15	68	160	9
29	208	9	69	156	16
30	247	4	70	150	18
31	35	50	71	26	16
32	17	173	72	237	19
33	10	162	73	230	19
34	.....	1	74	232	19
35	139	5	75	227	19
36	278	29	76	228	19
37	200	24	77	225	18
38	248	1	78	210	18
39	235	1	79	229	18
40	37	115	80	234	18

1 Vol. X., Part 1, bound in half morocco.

Very respectfully,

H. G. DRESEL,

Lieutenant, U. S. Navy, Secretary and Treasurer.

OFFICERS OF THE INSTITUTE.

President.

REAR-ADMIRAL S. B. LUCE, U. S. NAVY.

Vice-President.

CAPTAIN PHILIP H. COOPER, U. S. NAVY.

Secretary and Treasurer.

LIEUTENANT H. G. DRESEL, U. S. NAVY.

Board of Control.

Commander EDWIN WHITE, U. S. Navy.
Commander ASA WALKER, U. S. Navy.
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Lieutenant E. B. UNDERWOOD, U. S. Navy.
Lieutenant DAVID DANIELS, U. S. Navy.
Professor N. M. TERRY, A. M., Ph. D.
Lieutenant H. G. DRESEL, U. S. Navy (ex-officio).

EXCHANGES (AMERICAN).

American Chemical Journal.
American Electrician.
Army and Navy Register.
Army and Navy Journal.
Baltimore Life.
Bulletin of the American Geographical Society.
Bulletin of the American Iron and Steel Association.
Bulletin of the Geographical Society of California.
Cassier's Magazine.
Colliery Engineer.
Electrical Engineer.
Engineering News and American Railroad Journal.
Engineer (New York).
Engineering-Mechanics.
Geographical Survey of Missouri.
Iron Age.
Journal of the American Society of Naval Engineers.
Journal of the Association of Engineering Societies.
Journal of the Franklin Institute.
Journal of the United States Artillery.
Journal of the United States Cavalry Association.
Journal of the Military Service Institution.
Lend-a-Hand.
Littell's Living Age.
Proceedings of the American Academy of Arts and Sciences.
Proceedings of the California Academy of Sciences.
Proceedings of the American Philosophical Society.
School of Mines Quarterly.
Scientific American.
Seaboard.
Stationary Engineer.
Technology Quarterly and Proceedings of the Society of Arts.
Transactions and Proceedings of the Geographical Society of the Pacific.
Transactions of the American Society of Mechanical Engineers.
Transactions of the American Institute of Mining Engineers.
Transactions of the American Society of Civil Engineers.
Transactions of the Connecticut Academy of Arts and Sciences.
Transactions of the Technical Society of the Pacific Coast.
United Service.

EXCHANGES (FOREIGN).

Annalen der Hydrographie und Maritimen Meteorologie.
Australasian Army and Navy and Defense Review.
Boletin del Centro Naval.
Boletin do Club Naval.
Bulletin l'Association Technique Maritime.
Conservatoire National des Arts Metiers.
Deutsches Heeres-Zeitung.
Engineering.
Engineer.
Journal of the Royal United Service Institution.
Journal and Proceedings of the United Service Institution of New South Wales.
Le Moniteur de la Flotte.
Marine Rundschau.
Militär Wochenblatt.
Minutes and Proceedings of the Institution of Civil Engineers.
Mittheilungen aus dem Gebiete des Seewesens.
Mémoires et Compte Rendu des Travaux de la Société des Ingénieurs Civils.
Morskoi Sbornik.
Norsk Tidsskrift for Sovaesen.
Proceedings of the Royal Artillery Institution.
Proceedings of the Institution of Mechanical Engineers.
Revista Maritima Brazileira.
Revista Tecnologico Industrial.
Revue du Cercle Militaire.
Revue Maritime.
Rivista di Artiglieria e Genio.
Rivista Marittima (Rome).
Steamship, The.
Teknisk Tidskrift.
Tidskrift i Sjovasendet.
Transactions of the Canadian Institute.
Transactions of the Canadian Society of Civil Engineers.
Transactions of the Institution of Naval Architects.
Transactions of the North of England Institute of Mining and Mechanical Engineers.
Transactions of the Northeast Coast Institution of Engineers and Shipbuilders.
United Service Gazette.
Le Yacht.

SPECIAL NOTICE.

NAVAL INSTITUTE PRIZE ESSAY, 1898.

A prize of one hundred dollars, with a gold medal, is offered by the Naval Institute for the best essay presented on any subject pertaining to the naval profession, subject to the following rules:

1. The award for the prize shall be made by the Board of Control, voting by ballot and without knowledge of the names of the competitors.

2. Each competitor to send his essay in a sealed envelope to the Secretary and Treasurer on or before January 1, 1898. The name of the writer shall not be given in this envelope, but instead thereof a motto. Accompanying the essay a separate sealed envelope will be sent to the Secretary and Treasurer, with the motto on the outside and writer's name and motto inside. This envelope is not to be opened until after the decision of the Board.

3. The successful essay to be published in the Proceedings of the Institute; and the essays of other competitors, receiving honorable mention, to be published also, at the discretion of the Board of Control; and no change shall be made in the text of any competitive essay, published in the Proceedings of the Institute, after it leaves the hands of the Board.

4. Any essay not having received honorable mention, may be published also, at the discretion of the Board of Control, but only with the consent of the author.

5. The essay is limited to fifty (50) printed pages of the Proceedings of the Institute.

6. All essays submitted must be either type-written or copied in a clear and legible hand.

7. The successful competitor will be made a Life Member of the Institute.

8. In the event of the Prize being awarded to the winner of a previous year, a gold clasp, suitably engraved, will be given in lieu of a gold medal.

By direction of the Board of Control.

H. G. DRESEL,
Lieut., U. S. N., Secretary and Treasurer.

ANNAPOLIS, MD., *January 1, 1897.*

ASBESTOS

TRADE MARK

This trade-mark, the address 87 Maiden Lane, and the name H. W. Johns Manufacturing Co., have been so long associated that the mention of one immediately suggests the other two to those who have been served by the varied manufactures of this company. The offices at 87 Maiden Lane were established 25 years ago, and it is therefore after long hesitation that a change in address has been decided upon. Department has been added to department, and the trade has increased until each has assumed the proportion of a large business in itself, and a removal has been absolutely necessary.

The ground floor of the new Woodbridge Building at William, John and Platt streets has been leased and is now being fitted up for salesrooms, accounting department and private offices, and the basement for stock.

It is to be one of the handsomest offices in the metropolis, and with these increased facilities the company promises even more perfect service to its customers than in the past.

The facile power of adapting inventive genius to practical purposes possessed by Mr. Johns, who is still the active head of the business, has rendered his discoveries of the peculiar and valuable properties of this wonderful mineral of the greatest importance to man. The products of asbestos are now indispensable for household and mechanical purposes. Liquid paints, roofing and other fire-proof construction materials, heat insulating coverings for steam pipes, boilers, etc., steam packings, fire-proof cements, cloth, rope, cord, twine, and numerous other articles which space prevents our mentioning, all bear the trade-mark of this company, which always means excellence.

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ARMOR:

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The Annapolis Armor Test, with Report of the Board.

Introduction by Lieut. E. W. Very, U. S. N.

Face-Hardened Armor.

By Lieut. A. A. Ackerman, U. S. N

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Notes on Naval General Courts-Martial, with a Form of Procedure, 15 cents.

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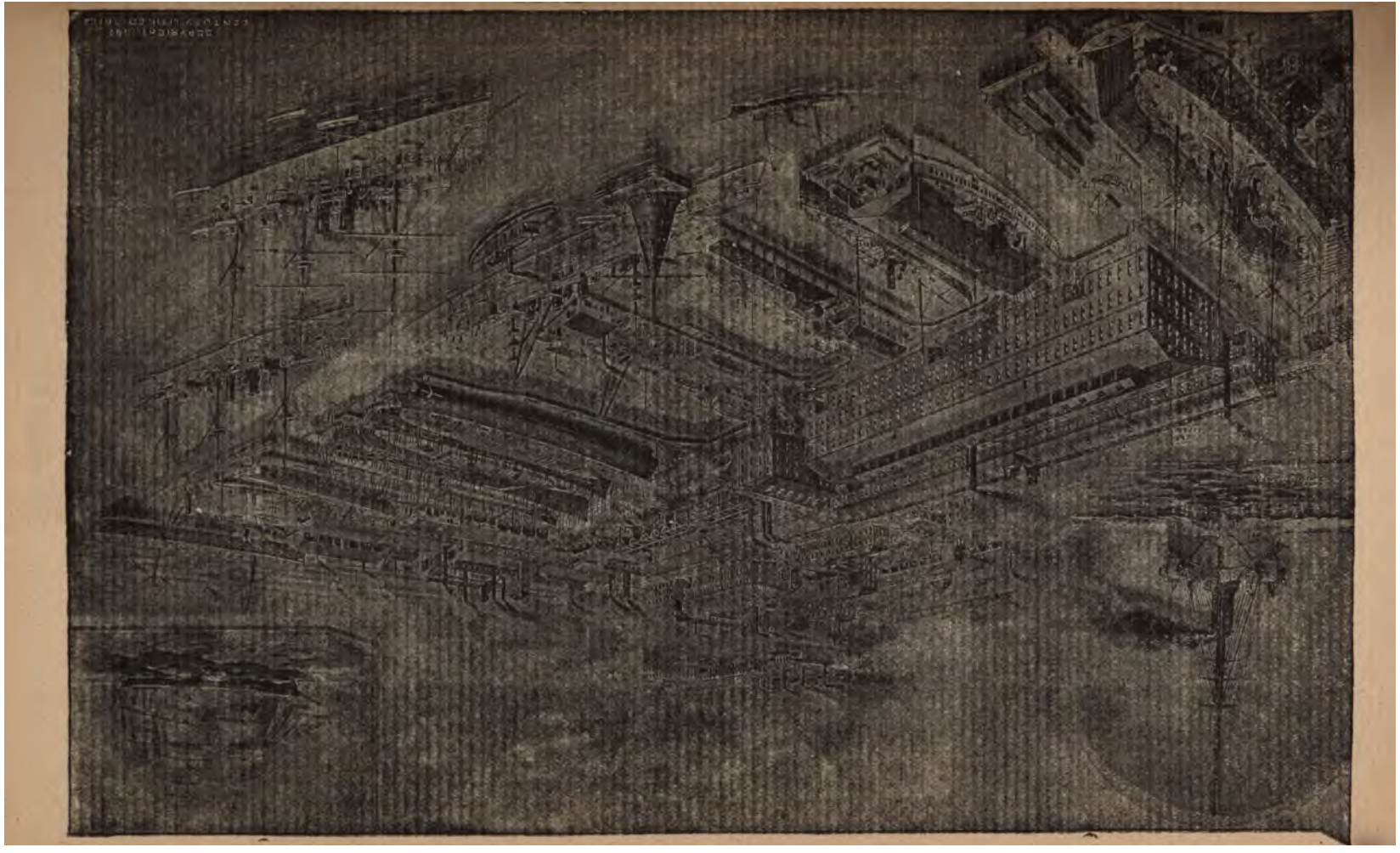

NOTICE.

The U. S. Naval Institute was established in 1873, having for its object the advancement of professional and scientific knowledge in the Navy. It now enters upon its twenty-fifth year of existence, trusting as heretofore for its support to the officers and friends of the Navy. The members of the Board of Control cordially invite the co-operation and aid of their brother officers and others interested in the Navy, in furtherance of the aims of the Institute, by the contribution of papers and communications upon subjects of interest to the naval profession, as well as by personal support and influence.

On the subject of membership the Constitution reads as follows:

ARTICLE VII.

Sec. 1. The Institute shall consist of regular, life, honorary and associate members.

Sec. 2. Officers of the Navy, Marine Corps, and all civil officers attached to the Naval Service, shall be entitled to become regular or life members, without ballot, on payment of dues or fee to the Secretary and Treasurer, or to the Corresponding Secretary of a Branch. Members who resign from the Navy subsequent to joining the Institute will be regarded as belonging to the class described in this Section.

Sec. 3. The Prize Essayist of each year shall be a life member without payment of fee.

Sec. 4. Honorary members shall be selected from distinguished Naval and Military Officers, and from eminent men of learning in civil life. The Secretary of the Navy shall be, *ex officio*, an honorary member. Their number shall not exceed thirty (30). Nominations for honorary members must be favorably reported by the Board of Control, and a vote equal to one-half the number of regular and life members, given by proxy or presence, shall be cast, a majority electing.

Sec. 5. Associate members shall be elected from officers of the Army, Revenue Marine, foreign officers of the Naval and Military professions, and from persons in civil life who may be interested in the purposes of the Institute.

Sec. 6. Those entitled to become associate members may be elected life members, provided that the number not officially connected with the Navy and Marine Corps shall not at any time exceed one hundred (100).

Sec. 7. Associate members and life members, other than those entitled to regular membership, shall be elected as follows: Nominations shall be made in writing to the Secretary and Treasurer, with the name of the member making them, and such nominations shall be submitted to the Board of Control, and, if their report be favorable, the Secretary and Treasurer shall make known the result at the next meeting of the Institute, and a vote shall then be taken, a majority of votes cast by members present electing.

The Proceedings are published quarterly, and may be obtained by non-members upon application to the Secretary and Treasurer at Annapolis, Md. Inventors of articles connected with the naval profession will be afforded an opportunity of exhibiting and explaining their inventions. A description of such inventions as may be deemed by the Board of Control of use to the service will be published in the Proceedings.

Single copies of the Proceedings, $1.00. Back numbers and complete sets can be obtained by applying to the Secretary and Treasurer, Annapolis, Md.

Annual subscriptions for non-members, $3.50. Annual dues for members and associate members, $3.00. Life membership fee, $30.00.

All letters should be addressed to Secretary and Treasurer, U. S. Naval Institute, Annapolis, Md., and all checks, drafts and money orders should *be made* payable to his order, without using the name of that officer.